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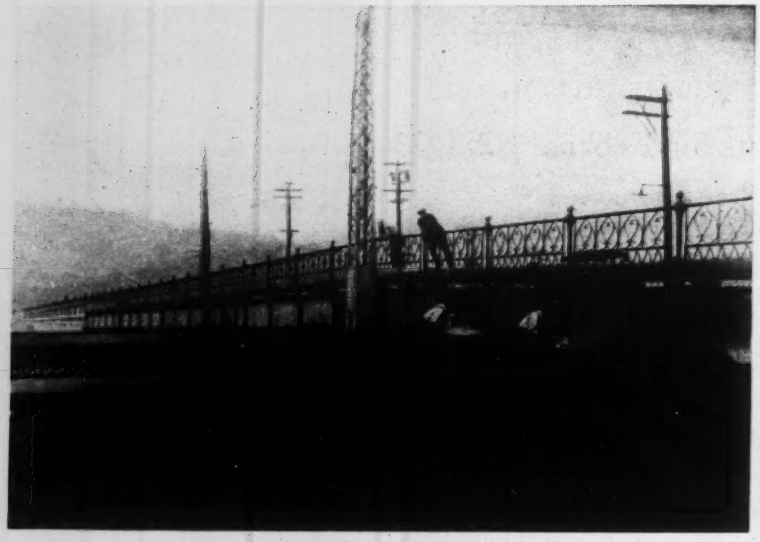

HIGHWAY BRIDGE, NEW YORK CITY
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Engineering
News-Record

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ENGINEERING PROGRESS, 1932-1933

CONSTRUCTION and the engineering arts that serve it experienced during 1932 the full impact of the economic upheaval that was already in tumultuous progress a year ago, and as a result they are in a critical state. Accurate orientation of our present position would need to consider all the facts of current political and economic happenings, which is all but impossible. The major facts bearing on civil engineering and construction, however, are reflected in the happenings in the field itself. The present issue therefore reports them in a group of articles and includes as well our usual editorial review of developments in the art and our summaries of construction statistics and of the progress made on large engineering undertakings now active.

◆

Critical Times

CONSTRUCTION in 1932 dropped precipitously to less than half the preceding year's volume and to one-third of normal requirements. This calamitous record was essentially determined by the succession of critical events that marked the economic year. In a general sense the events were those attendant on continuing deflation, with the financial consequences of decrease in credit and confidence, progressive price decline, unbalance of currencies and defaults or freezing of debts.

Business and industry suffered from further shrinkage, loss of foreign trade and the growing burden of fixed charges, all intensifying the previous effect of diminished purchasing power. Unemployment grew to unprecedented magnitude—estimates range from 12 million upward—giving rise to wide distress and popular restlessness, revealed in some parts of the country in tax strikes or mass resistance to mortgage foreclosure sales.

The economic events occurred in the face of favorable natural conditions, good crops and absence of natural catastrophes. The paradox of plenty displayed itself most strikingly; the ample gifts of nature and our wealth in productive facilities could not be made effective to prevent distress and poverty among ~~thousands or~~ millions of people. That labor disturbances and violence were negligible despite the provocation of such happenings indicates a high degree of stability of mind among the working classes.

Financial Complications

UNDER these conditions the first half of the year was dominated by threatened breakdown of our entire banking system, only gradually relieved by the creation and functioning of the Reconstruction Finance Corporation. Pressure for liquidity of bank funds tightened credit, subjected business and industry to increased strain, added to the already large army of unemployed, and made new long-term bond issues unmarketable, so that construction was squeezed to even smaller dimensions. A further unfavorable reaction on construction arose from extreme seeking for expense reduction and unwillingness of citizens to enter into increased obligations due to their inclination to look upon new capital investment as equivalent to expense. While these conditions were leading to extensive contraction in public works, corporate and private construction all but vanished. The rapid downward course of construction activity and planning reacted in turn on engineering activity; public and corporate staffs were reduced everywhere, and private engineering business decreased to a minimum.

Productive Power Lost

HOW FAR the imperfect functioning of the banking system affected the country's business became apparent in many ways, among them the resort to token money in many communities to take the place of currency, the establishment of barter agencies to permit of doing business without dependence on money, and, not least important, the inability of the Federal Reserve Board to force credit out into the channels of industry and trade, even through the powerful means of purchasing more than a billion dollars of securities in the spring and thereby making available huge potential credits. Though this made money so cheap as to bring short-term federal loans down to interest rates of one-fifth of 1 per cent per annum, neither business credits nor long-term money became easy. Not until summer did bond prices begin to rise, and only late in the year did

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municipal and state bonds obtain a ready market. By this time the popular mind had been set firmly against investment in new facilities.

Despite the unprecedentedly low cost of construction today, the public therefore is unwilling to take advantage of it. The resulting loss of wealth contributes to the prodigious loss that the country has suffered through waste of productive power by unemployment, estimated as high as thirty to fifty billions of dollars per year.

New Trends of Thought

THE severe experiences of the times have produced important activation of thought in many matters bearing on engineering and construction. Most people today believe that there is something wrong in an industrial mechanism that has ample power to produce but cannot distribute its product to those who need it. This belief is arousing thought not only about financial reform but also about the direct dependence of industrial health on social health through the effect of consumer purchasing power; about planned production, and budgeting of construction programs; about industrial regulation either by government agency or by industries themselves; about distribution of surplus production without undue increase of investment in new plant facilities; about control of working time, insurance against unemployment and similar matters. Control of working time has already found temporary recognition, in the thirty-hour-week provision of the Relief and Construction Act. Unemployment insurance is being considered by several legislatures.

Partial recognition has been given by the Relief Act also to a national responsibility for the maintenance and employment of citizens. Discussions of how national and local planned programs of public works can be utilized for maintaining employment and counterbalancing the ups and downs of business are a further approach to recognizing such public responsibility. Another is shown in the national recognition of publicly-aided housing construction through the Relief Act. In industrial circles also new vigor of thinking has been revealed in the last few months.

These new trends of thought, coupled with study of more equitable taxing systems, promise far-reaching effect on many features of business and social life. They are likely to influence construction profoundly, and the engineer will find it important to follow their development. The particular subject of utilizing public works for coping with unemployment is at the moment the matter of greatest importance.

Public Works and Business Recovery

WITH public as well as private work declining rapidly, unemployment increased during the first seven months of the year. Long before, foreseeing this condition, many interests had begun active efforts to check unemployment through the stimulation of public works. These efforts came to a head in May in a concerted drive for federal financing of needed public works of local governments. The American Society of Civil Engineers was active and assisted in drafting the bills that finally emerged as the Emergency Relief and Reconstruction Act of 1932, approved by the President in July. More detailed comment on that act is given elsewhere in this issue. Interpretations put upon the act by the R.F.C. largely nullified the section designed to provide a fund of a billion and a half for public works other than highways and federal buildings, so that no appreciable reduction of unemployment resulted from that section. On the other hand, $102,000,000 of the $120,000,000 provided for highways was taken up by the states and made effective in increasing employment. Much of the money for federal building work was put to use, and $104,000,000 was loaned to states for direct relief. Nevertheless, unemployment continued to increase. There is good reason to believe that the Relief Act will be amended to facilitate the release of funds for public work during 1933.

Another measure planned for indirect aid to employment was the Home Loan Bank Act, designed to help home-financing organizations over their difficulties and so check mortgage foreclosures, thus improving the whole credit situation. The act, however, did not begin to function quickly enough to provide any employment, and from the present outlook is not likely to be effective soon in promoting housebuilding.

Up to the very close of the year the belief held sway in many circles that charity or dole methods are the cheapest devices for handling unemployment distress. It has been well said that economy arguments have made the country dole-minded rather than employment-minded. But there is an increasing number of men who hold that the only cure for unemployment is employment, and that when private business stops and discharges its workers the state should put them to work.

Spreading Employment

ONE notable contribution of the Relief Act to reduction of unemployment was its effect in spreading work by limiting the weekly working hours of the individual and by increasing hand-labor operations. Requirements to this effect (30 hours' work per week, and the practicable maximum of hand labor) were written into the act. Similar practices were applied in other work through bureau orders and the individual initiative of private builders. The plans of labor distribution differed; in most cases they involved staggered employment, or work-sharing. The time limitations, where intelligently limited and executed, functioned generally without reducing construction speed and economy. Less general success was had with hand-labor practice; here the results varied from excellent to disastrous, according to the intelligence of planning and supervision. Where the tasks were well selected and intelligently coordinated with machine operations, hand labor made smaller inroads on equipment efficiency than elsewhere. A broad 30-hour-week bill now in Congress proposes to extend the plan to general industry by prohibiting interstate transportation of products not made on short hours.

Municipal Stagnation

STAGNATION amounting almost to paralysis of municipal engineering activities was among the outstanding developments of the year. Because of it, 1932 brought city and state construction to the lowest point in a decade, and engineering staffs were decimated.

Beginning even before the end of 1931 the deflationary forces that have held control of the world's business activities for the past three years directed their attack

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against municipal affairs. Reduced private income made tax payments difficult, and delinquencies rose to 20 and 30 per cent. Deficits in local government budgets became frequent; bankers refused to advance temporary credits unless expenditures were reduced, and real-estate owners and business men supported the refusal. Expense-reduction moves became the order of the day, with approval of the public at large, and the wheels of municipal activity began to slacken speed.

Capital outlays were first to feel the effects. The financial community frowned on bond issues for public construction, and it was out of the question to provide for capital items out of income. Public improvement projects that had long been planned were placed on the deferred list, and more thousands joined the unemployed. Current operating budgets came next. Urged on again by tax-protest groups, city officials began to pinch on service costs. Activities not of immediate and obvious benefit were dropped or curtailed; employees' salaries were cut, in the case of protected classes often by enforcement of "voluntary" reduction or rebating; teachers, policemen, firemen and technical employees still holding their positions began to feel the depression in full force. As budgets for 1933 came up for consideration, in view of the necessity in most cases of borrowing money for operation until tax collections should come in, the bankers assumed the position of approving or disapproving the plans for community activity and development.

That was the condition at the end of 1932. Some faint glimmerings of improvement have been seen since then. Municipal securities, which in many cases had no market at all several months ago, have improved. The banks are anxious to invest their hoarded money, and since municipal bonds still represent greater security for investment than do the obligations of industrial activity, they command a high price. Banker opposition to new capital expenditure thus has weakened in recent weeks, but the great body of citizens had already been convinced that salvation can only be achieved through drastic economy, and so municipal activity remains stagnant.

Improving Public Administration

INDICATIONS of definite thinking along broad lines of governmental economy are shown in many ways. Centralization of federal construction in a public-works division of the Interior Department was proposed by the President but disapproved by Congress. The same thinking is reflected in city and state reorganization studies and in the growing consolidations in highway administration. A disposition to shift the burden of all road improvement upon motor-vehicle users, with increased diversion of state motor-vehicle tax money to counties and towns, indicated the need of other and better business and technical direction than can come from small-community management. This has taken the form of continued centralization. Following the example of North Carolina, all roads in Virginia have been put under state control. Michigan has continued to merge its township roads into its county road systems. Pennsylvania, which took 20,000 miles of selected township roads into the state system in 1931, indicated plans for further absorption. Indiana has transferred all township roads to the counties and other states have made partial mergers of administrative authority. These activities represent a determined trend of highway policy toward increased consideration of local roads, wider distribution of motor-vehicle taxes and greater centralization of administration for economy.

Planning and Budgeting

AS THE financial difficulties of governments which were prominent during the year proved to be due in part to unwise methods of paying for capital improvements and in part to lack of public-works programs, advance planning and budgeting of improvements received much thought. From being theories they are coming to be recognized as devices essential to the public welfare. An impetus was given to this thinking by the studies of the Federal Employment Stabilization Board, which brought to light the haphazard procedure under which fixed improvements are projected and authorized by the national government. The study indicated that advance budgeting of improvements is possible and would not only stabilize and coordinate federal operations but would also permit more effective utilization of government construction for balancing the fluctuations in private industry. The application of budgeting to state and local government construction is conceded to be equally desirable. Segregation of capital outlays from current expenditures also is coming to be regarded as an essential reform in government method, and while the federal government has not recognized it other government authorities are promoting its adoption. Both budgeting and financial segregation of capital outlays from current expenditures are likely to make progress in the early future.

Housing

LARGE-SCALE low-cost housing became a focal point of widespread interest during the year. Actually, promise exceeded accomplishment, no construction being carried out, but estimates place the number of projects under study at close to 100. This is remarkable advance for what a year ago was little more than a sociological theory and a Utopian dream. The explanation for this unusual change lies in the impetus afforded by the Relief Act, which listed housing projects as self-liquidating and eligible for loans. Coincident with this practical turn of events has been a growing acceptance of the idea that low-cost housing deserves to be regarded in the light of a public utility, to be aided and regulated by government. Tax exemption, low interest rates and power of condemnation are among the aids proposed. Minimum requirements for sunlight, air, play facilities and pedestrian safety come under the head of regulation. The only project for which an R.F.C. loan was granted —that of the Hillside Housing Corp., to be located in the Bronx, New York City—was temporarily obstructed by politics. But experimentation with new building materials and new and improved adaptations of existing materials was active. With liberalization of the Relief Act and a continuing public interest, some notable housing accomplishments should be recorded in 1933.

Throughout the country there was pronounced interest and more than ordinary activity in modernization and reconstruction of buildings, homes and apartment houses. A goodly amount of this activity originated in the fact that financial institutions, acquiring ownership through foreclosures, endeavor to make the structures produce

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increased revenue. Modernization promises to be an even more important factor in the building field in 1933.

Building Activity

BUILDING construction presents the paradox of being statistically at a virtual standstill and yet making a record tempo of activity in specific instances. Rockefeller Center, in New York, afforded the outstanding example in the field of private enterprise. At the beginning of 1932 only twenty stories of steel in the thirty-story RKO Building were erected. By Jan. 1, 1933, this building was complete, two theaters were in operation, the 69-story RCA Building, larger in floor area than the Empire State Building, was nearly complete and a six-story building was partly inclosed. More than 50 per cent of the three-block site is now covered with structures, inclosing a volume of about 55,000,000 cu.ft. On the public-construction side of the ledger, work on government buildings in Washington, D. C., and on federal courts and post-offices throughout the country is notable. Residential construction, however, showed little activity.

Some Innovations

FEW new office buildings were built, but several of these are significant. The 67-story Cities Service Building in New York (Sixty Wall Tower) by virtue of a tall flagpole became upon its opening in the summer the third tallest building in the world; it is most notable, however, for its pioneer installation of double-deck elevators. In Philadelphia the new Savings Fund Society Building affords an example of unusual architecture and interesting structural engineering. Air for the entire building is conditioned for moisture, temperature and cleanliness. The Gulf Oil Building in Pittsburgh, completed during the year, utilized unusually long-span floor framing of double girders to eliminate practically all columns in the rentable areas. In Dayton the nineteen-story tower of the new Mutual Home and Savings Association Building was carried on a four-sided rigid frame, consisting of plate girders top and bottom and trussed columns. Cincinnati finished its union railroad terminal building, Los Angeles completed a new municipal auditorium, and in New York the Port Authority's inland freight terminal and factory of sixteen stories covering a 200x800-ft. site was opened.

In Chicago the buildings being built for A Century of Progress show clearly the results of a studied attempt to make them unusual in appearance and economical in first cost. The architecture is dominated by plain facades, devoid of windows. Low cost is being achieved largely by eliminating field work, by a maximum of shop fabrication of walls, partitions, floors, wiring layouts and other elements adapted to pre-assembly.

Bridges

IN bridges as in buildings the year showed a heavily reduced volume of work. Only two or three new projects of large size are under development. Most of the activity was occasioned by completion of structures started previously, among them the George Westinghouse Bridge at Pittsburgh, whose 460-ft. center span is the longest concrete arch in America; the 547-ft. Tyngsborough steel arch, the largest in Massachusetts; the Arlington Memorial Bridge in Washington, D. C.; the double-deck Western Hills Viaduct in Cincinnati; the Lorain-Carnegie Bridge over the Cuyahoga Valley in Cleveland; the Burrard St. Bridge in Vancouver; and the Bixby Creek Bridge, whose 320-ft. concrete arch span is the longest in California. The Rogue River Bridge in Oregon, a series of concrete arches in whose construction the Freyssinet method of decentering and stress adjustment was utilized, was opened to traffic. The South Tenth St. Bridge over the Monongahela River in Pittsburgh, which was virtually completed, is also important as being the first wire-cable suspension structure in a city that boasts notable examples of almost every other type of bridge.

Interest in great bridges shifted abruptly during the year from the eastern part of the country to San Francisco Bay. Contracts were let for the 4,200-ft. span Golden Gate suspension bridge, financed by a banking syndicate, and preparations were made for calling for bids on the Bay Bridge between San Francisco and Oakland. The R.F.C. provided funds for the latter project, which in its 7½ miles will include two consecutive 2,310-ft. suspension spans with intermediate anchorage sunk in deep water, a 1,400-ft. cantilever span and a double-deck tunnel accommodating a 60-ft. roadway. The only other large project that was advanced during the year was the long-delayed Mississippi River cantilever at New Orleans. Money being advanced by the R.F.C., contracts were let at the end of the year for this combined railway and highway structure.

The War Department requirement for removable spans over the new Illinois Waterway caused the construction of a number of bridges, the most notable one being a 302-ft. lift span at Joliet for the Rock Island R.R. The Albany-Rensselaer highway bridge over the Hudson includes a 341-ft. lift span, whose weight of 2,750 tons exclusive of counterweights makes it the heaviest yet built. An almost identical structure is being built at Troy, N. Y. Viaduct work is represented by the completion of the high-level viaduct over the New Jersey Meadows west of Jersey City and further work on the Ogden Ave. extension in Chicago.

A new record length was set for welded bridges by a 161-ft. span through truss in Czechoslovakia. An 1,850-ft. transporter suspension span known as the Skyway, planned for the World's Fair in Chicago, got under way during the year and will doubtless attract attention during 1933.

Structural Advance

FEW analytical methods of design have excited so much interest or obtained so large a following in a short time as the Cross method of fixed-end moment distribution. Its inherent simplicity and efficiency is rapidly supplementing the growing recognition of the advantages and practicability of statically indeterminate construction. During the year light-weight floors, both for buildings and bridges enjoyed growing acceptance. A pressed-steel floor of hollow beam units was utilized in a warehouse in Pittsburgh. For bridges, floors of open steel mesh of interlocking steel channels with asphalt-plank wearing surface and of concrete-filled steel grids were tried. Reinforced-brick masonry was used in a variety of new structures and is assuming a place of importance in construction. Technical advance in earthquake-

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resistant design has not been paralleled by comparable building-code improvement and therefore is finding little application in practice.

Developments in structural practice include the study of cements to develop a material of low total heat generation for use in Hoover Dam; the adoption of one of the cements developed in this study for Pine Canyon Dam in California, and later the specifying of two grades of low-heat cement for Hoover Dam; the development of welded trusses in which continuous straps are utilized as tension members, each strap forming two web members and a portion of the bottom chord; the solution of a major foundation problem, that of the deep piers of the San Francisco Bay Bridge, through the adoption of open-dredging caissons provided with roofed wells capable of acting on the diving-bell principle during the sinking of the caissons in deep water; and the design and fabrication of penstocks and tunnel linings 30 ft. in diameter with $2\frac{7}{8}$-in. shell thickness, welded along longitudinal and ring seams, for the Hoover Dam penstock tunnels.

Research

RESEARCH activities have been handicapped by the same lack of funds that affects everything else; nevertheless important results have been recorded. Virtual completion of the concrete column tests at Lehigh University and the University of Illinois and publication of the results were events of importance; some of the conclusions promise to affect design practice materially. Mass concrete studies with particular reference to the heat of hydration have been carried out in connection with the Hoover Dam design, and as a result a satisfactory low-heat cement has been developed with less tricalcium silicate and more dicalcium silicate than standard portland and a minimum of tricalcium aluminate. In other respects also the Hoover Dam project contributed to 1932 research. Dam model testing as an aid in stress analysis was continued. Spillway models were used for checking the hydraulic characteristics of the side-channel spillways. Erosion studies of concrete under high water velocity, investigation of flow conditions in models of the penstock and outlet pipe systems and model research on the action of large needle valves formed part of the program.

Research in the form of model testing formed an important element of the design procedure for the suspension spans of the Bay Bridge at San Francisco. Steel models were used, one nearly 100 ft. long. A special musical tensometer proved useful in determining variation of suspender pulls. In Cleveland the statically indeterminate stresses in a novel steel parabolic arch bridge of high rise having lateral bracing only in a relatively short length near the crown were determined by direct measurement on a celluloid model. Studies were continued at Battelle Memorial Institute, Columbus, Ohio, on the embrittling effect of punching, pickling and galvanizing on structural steel.

Welding research has been less active since completion of the structural welding committee's program, but weld structure is receiving more scientific attention than ever before, with some important results. Some pioneer tests of corrosion fatigue of weld metal were made at Lehigh University. The rigidity of welded beam-to-column connections was the subject of research at the University of Toronto. At Purdue University stress distribution in welded butt-strap joints was the subject of an extensive investigation. The ten-year program of steel column tests carried out at the University of Wisconsin for the American Society of Civil Engineers was brought to an end and reported upon.

Turning the Colorado

THE MOST important event in the construction field during the past year was the turning of the Colorado River into two of the diversion tunnels at Hoover Dam, marking the end of the preliminary stage of construction, reached a year ahead of schedule. The preliminary work of preparing the canyon bed for start of actual construction was marked by important developments. New rock drilling, blasting and mucking methods resulted in unprecedented speed in driving the huge diversion bores. Efficient concreting was carried on with the use of ingenious forms in lining the tunnels. The very magnitude of the Hoover Dam project called for construction operations to be conducted on an unusual scale, in canyon-wall scaling, spillway excavation and temporary road building. Both construction and engineering activities have been guided and bettered by an intelligent research program carried out during the past year. Future construction will spread into the fringe of little-known operations. A wholly untried cooling system will be installed to reduce the concrete setting temperatures inside the 3.5-million yard mass of concrete that will comprise the main dam. Literally miles of welded joints will be necessary for the fabrication of huge penstock pipes, every inch of which will be X-ray inspected. The largest cableway ever built will handle these pipes. Concrete placing methods will be developed to handle 175,000 cubic yards per month demanded by completion of schedules. Not only is a new construction tempo being set at Hoover Dam, but new heights of engineering and construction technique are being reached.

Water-Power Changes

THE pronounced decline in water-power development that began in 1931 continued through 1932, although the actual decline was not fully apparent because projects already begun continued to come into service. Thus, completion of the initial installations in such plants as that at Rock Island on the Columbia River, Safe Harbor on the Susquehanna, Beauharnois on the St. Lawrence and Chats Falls on the Ottada built up a noteworthy total of new water power. Abroad, 1932 saw the completion of the Dnieprostroy plant in Russia, a plant exceeded in size only by the Ontario Hydro's great plant at Queenston on the Niagara River.

Progress in water-power development as an art, however, has not been checked by the decline in demand for new developments. The 84,000-hp. turbines for Dnieprostroy were the largest built when they were installed; and they, with the two 83,000-hp. units for the Diablo plant at Seattle, marked a step in advance in the steady progress toward larger units for the base load of great power systems. Yet those turbines are soon to be exceeded by the turbines at Hoover Dam, the Bureau of Reclamation having recently called for bids on five turbines of 115,000-hp. capacity each. In another direction the year was marked by an increase in the head used on

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Kaplan (automatically adjustable blade propeller) turbines, one designed to operate under a head of 106 ft. having been ordered for the Shannon plant in Ireland. A few years ago such a high head was not considered possible with that type of turbine. The 42,500-hp. Kaplan turbines in the Safe Harbor plant, operating under lower head (55 ft.), are the largest of the type to date.

In quantitative importance water power reached a new high position. Because the demand for power was below normal and because water, generally, was plentiful, utility systems used their water-power plants as continuously as possible to reduce fuel consumption in their steam plants. Nearly 41 per cent of the 83 billion kw.-hr. generated was produced in water-power plants.

Dams

OVERSHADOWED in interest by the design and construction problems connected with Hoover Dam, the field of dam construction yet witnessed other important developments. The Owyhee Dam, completed during 1932, with its 530-ft. height from lowest foundation deserves more attention than it has received as an outstanding example of the best modern practice. For a few short years it is entitled to proper recognition as the world's highest, and in addition it has proved of particular assistance in serving as a field laboratory for new developments in the art particularly for the testing of principles that are to be incorporated in Hoover Dam. Many questions of heating, cooling and stress distribution were studied at Owyhee. Beyond the immediate influence of Hoover Dam, thinking inclined toward questions of economics and cost reduction. An outstanding event of the year was the recent award of contract for another record-breaking structure, the 360-ft. San Gabriel rock-fill dam, which is to contain 5,000,000 cu.yd. of rock and will be provided with the modern type of laminated concrete facing. For its type this structure is of particular importance. In still another field was the notable announcement of a code for dam design and construction by the state of Arizona. With state regulation becoming a definitely established fact, it is possible that this may be the forerunner of other regulations covering the minimum requirements acceptable to departments responsible for public safety in the matter of dam construction. In all, the year brought not only important developments in design and construction but also a remarkable activity in engineering study of the numerous complex problems presented by dams. From more than one point of view 1932 may prove to mark a significant date in dam-building advance.

Transportation Problems

CONTINUED decline of railroad traffic throughout 1932 made it the blackest year in railroad history. Early in the year, after needlessly long deliberation, the Interstate Commerce Commission granted the railroads a temporary increase in rates on many commodities, the surcharge to be pooled and used to aid the weaker lines in meeting their obligations. Late in January a wage reduction of 10 per cent was made. But while these changes were a material help, they did not begin to offset the falling off in traffic, and as a result many roads went into bankruptcy and others were kept from it only by borrowing from the Reconstruction Finance Corporation.

Increased competition from the still largely unregulated truck and bus industries further complicated the problems of the railroads. Though efforts for federal regulation have been at a standstill, notable progress has been made in state regulation. Within the past year or two a few states have passed laws for the regulation of motor transportation on the public highways, and in the several instances where these laws have been contested in the courts they have been supported, both in state supreme courts and in the U. S. Supreme Court. Thus the foundation has been laid for an adequate system of truck and bus regulation.

Railroad valuation work made little progress during the year. The only action of significance was announcement by the I.C.C. of a new valuation of the St. Louis & O'Fallon R.R., the line around which the legal fight over valuation methods has centered, and the U. S. Supreme Court's declaration that it would allow an appeal of the New Haven railroad from an I.C.C. decision not to consider its right to the use of property of another railroad as an element of value in fixing value for rate-making purposes.

On the technical side of railroad development, important innovations were: an entirely new type of passenger car for branch-line service; an experimental car for suburban service having the passenger capacity greatly increased by seats placed at two levels; further extension of aluminum to the construction of freight-car bodies to save weight; and the further application of air-conditioning to passenger-train service. The new cars for branch-line service have wheels equipped with pneumatic tires of a type developed in Europe, and bodies fabricated of thin formed plates of stainless steel.

Rapid-Transit Developments

OPENING of the main trunk of the new city-wide municipal subway in New York was the most important development in city transit during the past year. On Sept. 10 the north-and-south line through Manhattan Island, 12.3 miles long, was opened to traffic, the first in this country to be municipally operated. The fare is 5c. as on the city's privately operated subways, but after three years of operation the fare must be made sufficient to make the system self-supporting. Because the system now lacks important feeders it is far from self-supporting. This condition will be improved soon by putting into service some of the feeder lines into the outlying boroughs. Several sections are nearly completed. Meanwhile the Interborough (privately operated) rapid-transit system was put in the hands of receivers during the latter part of the year.

Elsewhere, a small amount of subway extension work was carried forward during the year in both Boston and Philadelphia, and in Newark, N. J., good progress was made on the city's new 4½-mile rapid-transit line, 1½ miles of which is in subway in the bed of the old Morris canal through the city. Chicago made no progress toward construction of its long-projected subway system, mainly because of litigation.

Less Road Construction

ROADBUILDING showed a pronounced decline in 1932 despite stimulus by large federal loans to increase employment. Road funds from motor-vehicle

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taxation were diverted in large amounts to charity relief use, not only by states but also by the counties and municipalities that received a share of such funds, for everywhere the demand for charity appropriations was great and tax income small. The emergency federal loans for high-building aid were made available too late in the year to count heavily in 1932 construction, and in fact scarcely more than balanced the sum of state-road money diverted for general relief. Thus the year presented the curious anomaly of states spending their own road money for other purposes and then borrowing federal money with which to build roads. Reliable figures of the year's new mileages are not available. Due to increased construction of low-cost roads, however, mileage figures are likely to show a smaller decline than the figures of expenditure. As to the latter, based on contracts let, the decrease of 1932 below 1931 is about 30 per cent in dollars. Since many of the contracts awarded late in the year cannot be counted as 1932 construction, the actual decrease may be a greater percentage. All these conditions will be intensified during 1933, on present indications. Diversion of road funds is even more popular than a year ago, and its effect in increasing unemployment is recklessly disregarded, even by public officials ranked as enlightened and progressive.

Roadbuilding Technique Improved

CONTINUOUS improvement of road structure and roadbuilding processes characterized the highway construction of the past year as it has for a dozen years past. Current improvement lies more in selection of materials and use of better construction tools than in invention of new road types. A revival of the old Hassam cement-penetration macadam construction and experimentation with an analogous cement-bound stone construction, using a new bituminized cement, both borrowed from European practice, constitute the nearest approach to new road types. Modern methods and equipment contributed materially toward giving these new cement-bound roads a promising place among current road types. In concrete-road construction a definite advance was recorded in truck-mixer practice, through improved spreading equipment. On one major operation a return was made to two-course construction with a layer of fabric between courses. For both bituminous and brick-surfaced roads a decided improvement was shown in concrete-base design to reduce cracking. Paving-brick manufacturers came forward with an improved product, de-aired brick, having greater strength and density. Brick-paving advance in other respects consisted in better filler and bedding-course practices. Bituminous materials increased their usefulness in the lower-cost road field by virtue of better control of materials, more careful construction procedure and increased mechanization. Emulsions gained in favor. In general there was a stepping up of quality and more refinement in all details of road construction.

Waterways

SIGNING of the St. Lawrence treaty was the most notable development in inland waterways. What the treaty's fate will be in the U. S. Senate remains to be seen. A Senate committee appointed to study the treaty has held hearings but has made no formal report. Ratification moves in Canada await action here. The prospects for ratification are not too bright. Meanwhile it is of interest to note that traffic through the Welland Canal increased this year, the first year that the deepened and modernized canal has been in operation; this is so despite adverse business conditions.

Water-Suply Progress

WATERWORKS construction was languishing when the year opened, due to the complete failure of the market for municipal bonds. It was recognized by the informed, however, that the number of water improvements ready for construction if financing could be provided would be a powerful factor in relieving unemployment and stimulating recovery. Accordingly, when the Emergency Relief and Construction Act of 1932 was drafted, waterworks were named specifically as one type of self-liquidating works obviously eligible for loans. Community water supply thereupon became one of the most important elements in the effort to combat the depression. The first loan made under the provisions of the Relief Act was for a waterworks project, the Colorado River supply for Los Angeles. When 1932 came to an end, nearly $50,000,000 had been made available by the R.F.C. for waterworks improvements.

Practices in supply and purification were further refined during the year. Interior lining for pipe became more popular, both because of the degree of protection afforded and because of the improved hydraulic conditions. Bleaching clay was introduced in water purification to aid coagulation and to adsorb phenols. Activated carbon continued to grow in use for the removal of tastes and odors, with nearly 400 plants equipped to use it when the year ended.

Refuse Disposal

ACTIVITY in garbage and rubbish disposal centered on methods of preparing contracts and specifications for the construction of new facilities. At Washington, D. C., a rubbish incinerator was put into service that had been contracted for on the basis of a design prepared by a consulting engineer. Baltimore entered into an unusual contract whereby an incinerator of closely specified performance is to be built and operated by a private company for a term of years, at the end of which time the plant is to become the property of the city. New York's program of building garbage-disposal facilities was started after great delay, but it is going to be difficult for the city to comply with the order of the U. S. Supreme Court to discontinue dumping garbage at sea by June 1 of the current year.

Sewerage and Sewage Treatment

LACK of adequate financing greatly hampered the construction of sewerage facilities. Chicago's large program of building treatment plants was brought to a standstill by the city's inability to sell bonds following its default on the first of the year. On the other hand, construction proceeded rapidly on the New York and Cleveland plants. Plans for sewage treatment in St. Paul and Minneapolis still wait upon enabling legislation, which does not appear to be an immediate likeli-

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hood, but Duluth has taken the first step toward a comprehensive system of sewage treatment by building an intercepting sewer along the lakefront.

Urged on by the self-liquidating requirement of the Relief Act and the strong opposition to tax-fund expenditures, engineers and public officials gave increasing attention to financing sewage-works construction by sewer-service charges. A number of states passed legislation enabling communities to finance their sewerage system on that basis.

Efforts to develop economies in sewage treatment have gone ahead with great vigor. Modified chemical precipitation methods have been revived and are being advocated energetically in some quarters. The Dearborn (Mich.) plant, started early in 1932, has not yet produced results sufficient to form an index of its performance and economy. Incineration of mechanically dewatered sludge has been shown experimentally to have great economic merit and is likely to come into widespread use in the near future.

Mississippi Flood Control

LEGAL and legislative questions involved in Mississippi flood control did not move forward toward solution during 1932. On Feb. 23 the United States Supreme Court handed down its anxiously awaited decision on the Kincaid injunction case. This decision reversed the previous district court decision granting the injunction, ruling the action of the lower court to be wrong but failing to pronounce on any of the controversial points that prompted the original action. On March 1 the Secretary of War announced the appointment (in response to a resolution by the flood control committee of the House of Representatives) of a board of two army engineers and one civilian to review the engineering features of the project laid down in the flood control act of April 15, 1928. This committee has not yet reported. Meanwhile construction on the project, with the exception of the floodways in dispute, has gone ahead actively, and the year closed with an unequalled record of levees completed. Surveys of the delta area and particularly experimentation at the Waterways Experiment Station at Vicksburg have been prosecuted vigorously. A notable outcome of the laboratory work was the undertaking and virtual completion of an artificial cutoff of one of the major loops of the river at Davis Island just south of Vicksburg. This is the first artificial cutoff projected by the government engineers, although in 1931 a natural cut-through of the river at Yucatan Bend was allowed to proceed without hindrance. The many controversial engineering, legal and economic questions of Mississippi flood control still remain for Congress to consider.

Chicago Drainage Canal

TAXATION difficulties in Chicago resulted during the year in the revival of the lake-levels case. The order of the U. S. Supreme Court, which became effective on July 1, 1930, requires the Sanitary District of Chicago to limit the diversion of water from Lake Michigan to 6,500 sec.-ft. until Dec. 31, 1935, to 5,000 sec.-ft. until Dec. 31, 1938, and to 1,500 sec.-ft. thereafter. Meanwhile the district is required to report semi-annually the progress made with its program of constructing sewage-treatment plants.

Material progress had been made on that program even before the court's decree became effective, and construction proceeded at a normal rate until the middle of 1931. Soon after, financial troubles stopped work, and on Jan. 1, 1932, bond interest and principal went into default.

The states of Wisconsin, Minnesota, Ohio, Pennsylvania, Michigan and New York, which had brought the original action against Chicago for diverting water from Lake Michigan, petitioned the Supreme Court in October to appoint a receiver for the district to carry out its construction program. Just before the year closed, the court instructed a master to make inquiry into the causes for the delay and to report back by April.

Professional Matters

DEFINITE increase in professional cooperation marked the year 1932. As noted in a similar review last year, relief work begun late in 1931 did much to arouse the fraternal spirit within the profession. That spirit continued to manifest itself in many ways during 1932, although professional society activities had to be curtailed because of reduced income, and even more serious effects may yet be experienced.

One notable event of the year was the settlement of the long controversy between architects and engineers in New York State resulting from attempts to limit the activities of engineers in the zone where the fields of the two professions overlap. Agreement was reached on the basis of setting up no restriction whatsoever to the activities of members of either profession.

This development is only one phase of a more general movement of mutual approach between the architectural and civil engineering professions, hitherto largely strangers to each other and often working at cross purposes. A noticeable trend within the professions toward recognizing the parallelism of their work and cooperating for better understanding and correlation was apparent during 1932. The chief agencies of cooperation up to now are building congresses and the Construction League, neither of which serves professional objectives.

Construction Integration

FOR THE first time progress can be recorded toward integration of the various groups concerned with construction. In most other fields some central focusing of thought and action was accomplished long ago, but the highly dispersed industry of construction looked upon such cooperation as an academic ideal until the past year revealed its practical importance. Construction was unable to make front against the attacks directed against it by other groups—railways, real estate bodies, taxpayers and industrial interests. In consequence the public failed at a critical time to recognize the essential service which construction renders in providing employment as well as in converting production into permanent wealth. The necessity of such defense and also the need for broad planning of construction to make it of maximum public usefulness slowly grew to be perceived by many leaders of construction groups as the year advanced, and out of this recognition came the virtual agreement to organize united action which was reached at the Detroit construction congress in the early weeks of 1933. Carrying this agreement into effect remains to be accomplished.

The Business Background of the Year's Events

Conditions in latter part of 1932 give encouragement as to better business in 1933—Records of the past depressions indicate that present depression has overrun its course—Business indexes show modest upturn

By Bernhard Ostrolenk
Economist, The Business Week

JANUARY, 1933, ushered in the fourth year of the depression with the problems of business recovery uppermost in the minds of all classes of people. *What of the future?* is the most anxious question that dominates public thought. The sanest and most reliable method of peering into the economic events of tomorrow is by noting the trends of the past, by adhering to the well-tested formula that "History repeats itself."

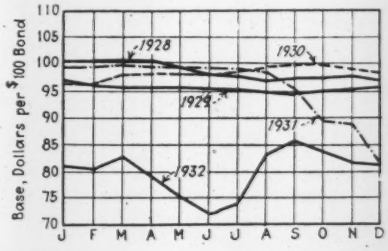
First, as to the depression as a whole, it should be noted that, when contrasted with the length of depressions in the past, the present depression has already overrun its course, and when coupled with recent data appears to have passed the low point. The 1920 depression, measured from a normal point of business activity, but already on the decline, to a corresponding normal point on the way up, took two years; the depression of 1907 lasted two years; the panic of 1893, if we exclude the brief recovery of 1895, lasted four years; the depression of 1884 lasted two and one-half years and the post-war depression, beginning in 1873, lasted six years. In all but the 1873 depression, recovery was well under way three years after the decline from the preceding peak. In the 1873 depression, business activity touched a low three years after the decline had started and though it made no further important declines it remained irregularly in the trough for three and one-half years.

Recovery after the 1873 depression is attributed to resumption of gold payments in 1879; the 1884 depression recovery is attributed to the subsequent railroad building years; recovery after 1893 is attributed to the defeat of the campaign for depreciated currency and the development of the electrical industry. Other recoveries came through gradual resumption of normal business. On the whole this latter may be the story of the present depression.

Indications of an upturn

Based on the history of past depressions, we are justified in the belief that, from the standpoint of time element, we are past the bottom, a view which is confirmed by a review of the important business indexes. Business activity for 1932 can be divided into two parts: that part that still saw business activity on the downward grade, when all business indexes were making new lows, when the depression was rapidly turning into a business panic, when bank failures and panic prices prevailed for commodities, stocks and bonds; the second part showed business indexes beginning to make modest recoveries, and during the last three months of the period moving sidewise.

During the first six months of 1932 the *Business Week* index of general business activity declined 15 per cent. During the next six months it recovered, dropped, moved irregularly sidewise and ended the year less than 2 per cent below the midyear point. Autumn expansion of trade activity was witnessed for the first time since 1929. Averages of stocks declined 47 points in the first six months, advanced 39 points in the following two months and ended the year 20 points above the low. Bonds fell 13 points and recovered 20 points.

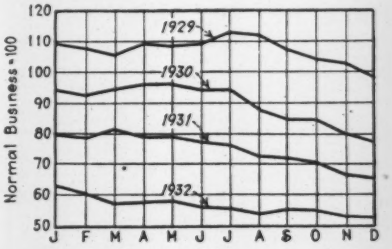


Bond-price index, using 60 high-grade bonds. The average monthly yield on the 60 bonds is converted to the equivalent price for a 4.40 per cent having 25 years to date of maturity. From data compiled by the Standard Statistics Co.

The fall in commodity prices slackened. The Labor Bureau's index of wholesale commodities declined 5 per cent in 1932; it had fallen 15 per cent in 1931 and 16 per cent in 1930. During each of the three months after June the average was raised, the longest recovery since 1929.

Bank suspensions were checked. Suspensions during 1929 totaled 642. During 1930 they rose to 1,345 and during 1931 to 2,298. But the total for the first eleven months of 1932 dropped back to 1,299, of which 838, or almost 70 per cent, suspended in the first six months.

Other more detailed and more technical data support this general trend. Gold stocks dropped 500 million dollars the first six months and increased 350 million dollars after June. Member-bank reserve balances dropped 500 million dollars during the twelve months before June, 1932, and since June have increased by 380 million dollars. The Labor Bureau's index of employment dropped 15.4 per cent during the first six months and advanced 9 per cent during the next three months.



Index of business activity compiled by the *Business Week* from steel-mill operations, building contracts, bituminous coal production, electric power output, non-bulk car loadings, check payments outside of New York, commercial loans of reporting Federal Reserve member banks and currency in circulation.

Improvements over January, 1932

On the whole, therefore, the economic position of the country at the opening of the year 1933 contrasts favorably with the situation when 1932 was ushered in. When 1932 was ushered in, the economic panic was in full swing. The failure of the Kreditanstalt in Austria in May, 1931, had started a series of events that brought with them worldwide repercussions. There followed rumors that Germany might be forced to declare a moratorium on all international external obligations, which brought about prompt liquidation of German bonds in New York. The drop in bond prices uncovered bank failures that rose to 167 in June.

In July President Hoover declared a moratorium that partly helped to stabilize conditions; but in August it had become apparent that the weakened German situation had frozen English credits so that a further decline in bonds was precipitated because of sales by London banks in New York to bolster bank balances in London and Berlin. Bank suspensions in August rose to 158 and again mirrored the bond decline. In September, 1931, the British situation developed into a new crisis, bringing about a flight of deposits from the larger New York banks and forcing New York banks to liquidate bonds, call loans, commercial paper and other securities in order to meet withdrawals. Subse-

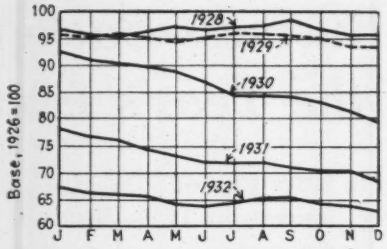
quently, a large export of gold to Europe developed, bringing with it fears on the part of the American people for the safety of the gold standard and their banks. Large withdrawals of deposits and the consequent hoarding forced the banks to sell bonds irrespective of the now utterly demoralized market and to rediscount eligible paper with the Federal Reserve banks in order to meet payments. Suspension of 305 banks in September and 522 in October, 1931, the record high for all time in any one month, again showed the sensitive response of the banks to the bond market.

The administration in Washington recognized the seriousness of the crisis and, in October, 1931, President Hoover created a temporary measure of self-help in the form of a National Credit Corporation. Fears of depositors were now temporarily allayed, and during November bank failures were only 175 against 522 in October. But because the National Credit Corporation was not sufficiently liberal and prompt in its loans, the effect on bond prices and bank failures was only temporary. The bond market registered a new low on December 17, 1931, bringing with it 358 failures. Another low for bond prices was touched on January 5, 1932, bringing with it 342 bank failures for that month. All in all, high-grade bonds had declined from 100.5, the high in March, 1928, to 79.1 the first week in January, 1932, a drop of 21.4 per cent.

Congress passes R.F.C act

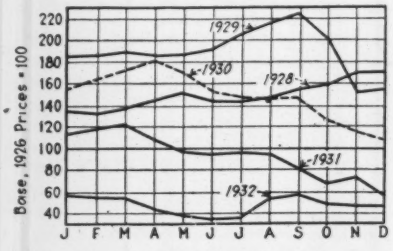
This was the situation at the opening of 1932. The act creating the Reconstruction Finance Corporation was rushed through Congress and signed by the President on Jan. 22, 1932. It provided for a Treasury subscription of 500 million dollars and a bond issue of one and a half billions, the total of two billions to be used principally to permit financing of banks and to aid in the financing of industry. Bank failures were now checked and totaled only 123 in February, 45 in March and 68 in April.

Emphasis here should be laid upon the sharp decline in bond prices, with its repercussion on financing of all construction work. The drop in bond prices registered the flight of capital from long-term investments into short-term investments, or in many cases, into liquidity. This was evidenced by the growth of cash in the banks and the extreme liquidity that now dominated financial institutions. This flight from the long-term bonds placed serious obstacles in the way of refinancing maturing obligations and made impossible the raising of new capital for construction. The serious state of industrial activity in consequence of the drop in the bond market cannot be overstated. Because of it the efforts of financial and governmental leaders were directed to turning the flow of capital away from the short-term market back into the long-term market where it could favorably influence business.



Wholesale commodity prices of 784 commodities. From data compiled by the U. S. Bureau of Labor Statistics.

The first important step in this direction was the passage of the Glass-Steagall Bill, whereby the Reserve banks were permitted to substitute U. S. government bonds for commercial paper in the issuance of Federal Reserve notes. Immediately afterwards the Federal Reserve banks started a campaign for lowering the rates for short-term paper, which in magnitude probably has no parallel in the financial history of the country. Within a period of three months more than one billion dollars of early-maturing U. S. government obligations were purchased, thus flooding the country with money and making scarce short-term paper. Short-term obligations for the latter six months of 1932 paid less than 1 per cent interest per annum. The purchase of these securities by the Federal Reserve banks gave the sellers cash which they were forced either to deposit in the banks and keep in cash, or invest in other short-term obligations at almost no profit rate, or they were forced into the long-term bond market. The first consequence, as expected, was that banks and financial institutions increased their reserves, paid off their obligation and remained liquid. In fact, in a very large measure this is the situation still at the opening of 1933. The policy of the Federal Reserve banks has succeeded in making credit available should business revive, and, to some extent, it has already succeeded in creating an overflow of funds from the short-term market into the long-term market. It is doubtful whether the banks can long remain in their present liquid position or can afford to lend their money at less than 1 per cent per annum. The banks and financial institutions are under great expense and must ultimately seek investment for their liquid funds.



Index of 421 industrial, rail and utility stocks based on 1926 prices as 100. From data compiled by the Standard Statistics Co.

Another factor that affected the business situation throughout the year was the debacle in railroad earnings. In March, 1932, the railroads were granted permission by the Interstate Commerce Commission to raise freight rates, but the advance was insufficient to cover expenses and funded debt. During 1932 Class I railroads as a whole have failed to earn any dividends and have failed to cover their funded debt. A large number of railroads, with the approval of the I.C.C., were helped by the R.F.C. during the year.

The farm situation during 1932 remained an evil case. Farm income for 1932 recorded a large drop to a little over five billion dollars, which contrasted with the average income of eleven billion dollars from 1920 to 1929. Farm income is equivalent to farm purchasing power, because all of this income is spent by the farmer for urban commodities. It does not matter whether it is spent for taxes, interest on mortgages, machinery, farm construction items or on many of the other commodities that a farmer buys. It all flows to the cities. The drop of six billion dollars in farm purchasing power was a heavy blow to urban industrial activity. A drop of six billion dollars in farm purchasing power was greater than the total exports of the United States at the peak.

Moreover, a large part of the farm indebtedness, which totals nine and one-half billions and which is held by commercial banks, insurance companies, federal land banks and other financial institutions, has become frozen. The farmer cannot pay the interest or taxes on his land. The average farm in Iowa has a mortgage of $10,000, or is mortgaged at the rate of about $60 an acre and pays about $300 taxes. This means interest payment of $3.60 an acre and $1.90 per acre taxes, making a total debt service per acre on an Iowa farm about $5.50. But oats were selling for 7c. a bushel, and a 40-bushel crop is considered large. Corn was selling for 14c. a bushel, wheat for 30c., and hogs for $2.25. In brief, the drop in farm prices has made the entire farm situation untenable and has sharply depreciated the value of farm mortgages.

It seems unnecessary to tell the agonizing story of the increase in unemployment, which, according to estimates by the Federation of Labor, is over twelve million, nor does it seem necessary to enlarge at this time on the foreign debt controversy that was dramatically brought before the country when England, France and other European countries appealed to the President for an extension of the moratorium in December. The moratorium was not granted, and France technically defaulted.

The new year 1933 opens with a Mona Lisa face, enigmatic, hopeful, promising.

The Statistical Picture of Current Construction

With 1932 work less than half that of 1931, activity is only 27 per cent of the 1928 peak—Production and price of materials are at correspondingly low levels—Capital issues decrease two-thirds

CONSTRUCTION in 1932 dropped to the small volume of 1916 work. At the beginning of the year indications pointed to a decrease of about 15 per cent from 1931, but almost complete stoppage of private work, coupled with severe retrenchment in public works, brought the estimated total value of all construction for 1932 down to 2.8 billion dollars, about 48 per cent of the 1931 figure and only 27 per cent of the estimated peak-year total of 10.6 billions in 1928.

Federal contract awards held up well, reaching 97 per cent of the 1931 volume, but all other general classes of construction suffered large setbacks during the past year. Residential building for the year was 35 per cent of that of 1931. Railroads and utilities were on little better than a maintenance basis. Highway construction, the largest in volume of any class, was 72 per cent of the 1931 total.

The decline of construction activity naturally affected the production of building materials. Every class of such materials suffered reduction in output except prepared roofing. Lumber output was at the lowest level in 60 years. Steel and cement production fell off to a lesser degree.

Prices of materials reflected the low demand, those of the three basic construction commodities (steel, lumber and cement) reaching long-time lows about mid-year. However, these prices stiffened in the last half of the year, the industries making an effort to pull away from below-cost levels.

All construction-wage scales declined during the year, though the skilled classes were affected most, due to a breaking away from union scales in many localities. Union scales were reduced in some places. Common labor rates in construction were lower near mid-year than at the close. Unemployment in all construction trades was acute.

TABLE I — ESTIMATED DOLLAR VALUE OF ALL CONSTRUCTION IN UNITED STATES
(Millions of Dollars)

	Residential	Public Works	Other	Total	ENR Cost Index
1919	1,160	1,640	740	3,540	198.42
1920	706	1,470	1,204	3,380	251.28
1921	1,100	1,510	860	3,470	201.81
1922	1,675	1,780	1,445	4,900	174.75
1923	1,980	2,300	1,590	5,870	214.07
1924	2,120	2,500	1,610	6,230	215.36
1925	2,704	2,476	2,998	8,178	206.68
1926	2,676	2,670	3,532	8,878	208.03
1927	2,544	3,073	3,978	9,595	206.24
1928	2,796	3,480	4,304	10,580	206.78
1929	1,934	3,263	5,180	10,377	207.02
1930	1,103	3,363	3,592	8,058	202.85
1931	812	3,098	2,020	5,930	181.35
1932	281	1,918	640	2,839	156.97

TABLE II — ESTIMATED VALUE OF ALL CONSTRUCTION BASED ON 1913 COSTS
(Millions of Dollars)

	Residential	Public Works	Other	Total	ENR Volume Index
1919	585	825	373	1,783	98
1920	281	586	480	1,347	99
1921	547	750	427	1,724	96
1922	960	1,020	830	2,800	147
1923	925	1,072	743	2,740	146
1924	987	1,160	743	2,890	154
1925	1,314	1,203	1,454	3,971	201
1926	1,286	1,280	1,745	4,311	228
1927	1,246	1,496	1,933	4,675	263
1928	1,351	1,691	2,080	5,122	287
1929	935	1,575	2,496	5,006	317
1930	544	1,654	1,770	3,968	260
1931	448	1,705	1,114	3,267	220
1932	179	1,222	408	1,799	127

Construction total

The exact total value of all construction operations in the United States cannot be ascertained. An estimate based on figures compiled by *Engineering News-Record* and other agencies totals $2,839,000,000, which is 52 per cent below the estimated 1931 total of $5,930,000,000. The 1932 volume is the lowest for the past sixteen years, being about equal to that of 1916. The all-time construction peak, 1928, is estimated at $10,580,000,000, followed by a $10,377,000,000 year in 1929. The twelve-year rise in volume of construction was wiped out in three years.

The 1932 total includes $281,000,000 of residential building, $1,918,000,000 of public works and $640,000,000 of other work, which includes utilities, commercial and industrial buildings and miscellaneous construction. The corresponding 1931 figures are $812,000,000, $3,098,000,000 and $2,020,000,000, respectively. On the 1913 price basis the volume of 1932 construction was $1,799,000,000 comprising residential $179,000,000, public works $1,222,000,000, all other $408,000,000. The totals of dollar volume and the 1913 structure volume are given in Tables I and II, and the dollar value for twelve years is plotted in Fig. 2.

Figures compiled by *Engineering News-Record* on construction activity

Fig. 2—The estimated value of all construction has dropped 73 per cent in the last three years.

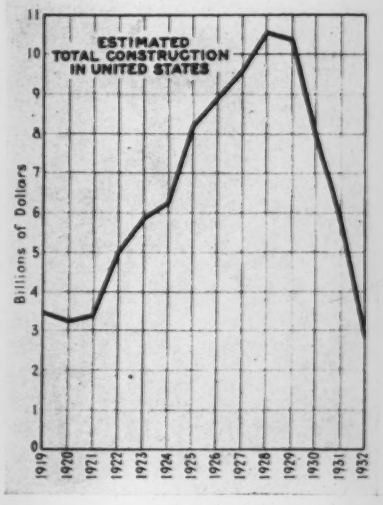
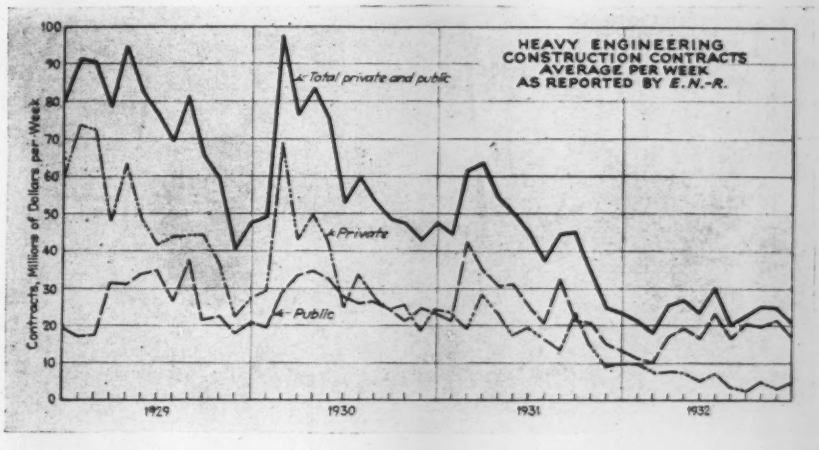
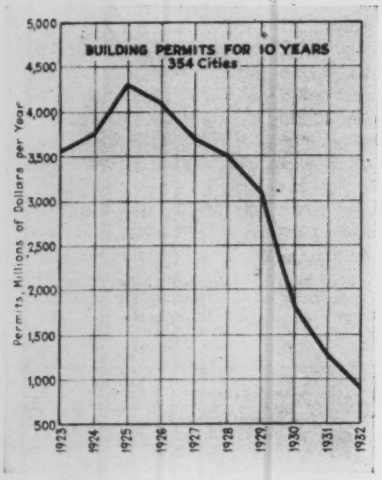


Fig. 1—Weekly averages of heavy contracts show the heavy decline of private work, formerly the bulwark of construction volume.



as indicated by contracts awarded are confined to heavy engineering construction work and take into consideration only contracts awarded above certain minimum amounts for each class. But the coverage is nation-wide in scope and is consistent from year to year. The statistics therefore are a sound measure of construction trends. The following figures relating to contracts awarded, unless otherwise noted, are based on compilations from our own coverage.

Fig. 3—Building permits, steadily declining since 1925, indicate what has happened in the residential and private building field.



The total of engineering construction contracts reported by *ENR* in 1932 is $1,219,309,000, or just half of the 1931 reports of $2,454,176,000. The 1932 contracts, separated into geographical districts and into various classes of work are shown in Table III.

Comparison of 1932 with 1931 contracts by classes reveals that every type of engineering construction except earthwork and waterways suffered a loss in volume. Private work fared worse than public work, falling off 69 per cent while public works lost 36 per cent. The belief that federal building and highway work were unusually heavy is incorrect, however, as federal contracts reported in 1932 were 3 per cent under those for 1931 and highway lettings showed a loss of 28 per cent. Contracts for public buildings, which fell off 47 per cent from the previous year's volume, were largely confined to federal projects, for state and municipal work of this class practically ceased. Earthwork and waterways awards showed the only increase for the year, gaining 12 per cent over the 1931 volume, due mostly to a full continuation of flood-control work on the Mississippi. Waterworks, though given some impetus through pushing of public works, showed a 39 per cent loss in contracts. Sewer construction declined 66 per cent.

In the field of private construction, industrial buildings made the best showing of any class, falling off 44 per cent, as compared with a loss of 70 per cent for commercial buildings and 95 per cent for private bridges. The proportion of each class of construction in 1932 in relation to its volume in 1931 is shown in the right-hand chart of Fig. 5.

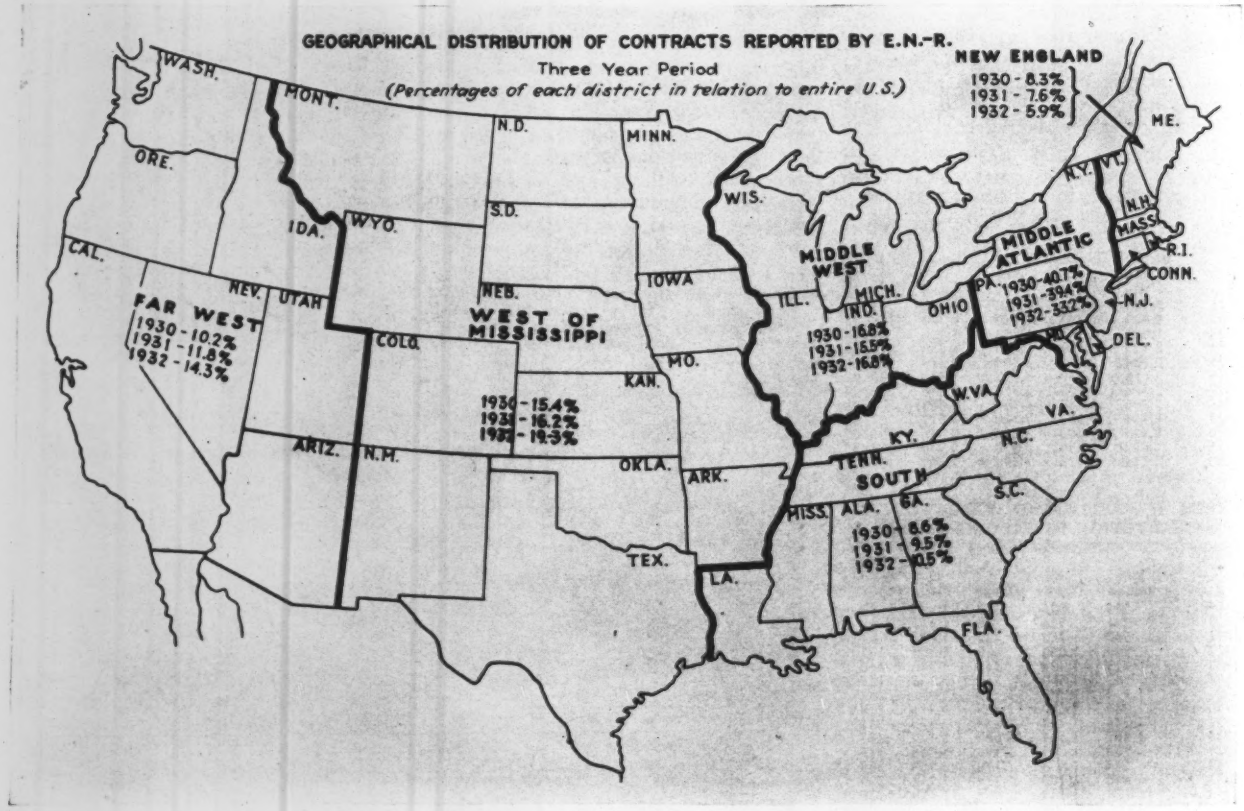
The weekly average of contracts let per month, as shown in Fig. 1, is an excellent barometer of construction activity.

Geographical distribution

Geographical analysis of contracts awarded during the past three years reveals that the Western, Far Western and Southern districts of the United States have been gaining in the proportion of all contracts awarded at the expense of the Middle Atlantic and New England areas. Percentages of contracts awarded in each district in relation to the entire country are shown in Fig. 4. The seven Far West states showed a gain from 10.2 per cent of the total in 1930 to 14.3 per cent in 1932, though the actual volume of construction in the West has not increased.

Comparison of actual contracts awarded in 1932 with those of the previous year, according to geographical districts, shows that the Far West fared better than any other section with a loss of 35 per cent in volume. Contracts in the west of the Mississippi area fell off 40 per cent from the 1931 volume.

Fig. 4—Geographical distribution of contracts for a three-year period shows gains in the West and South, declines in the East.



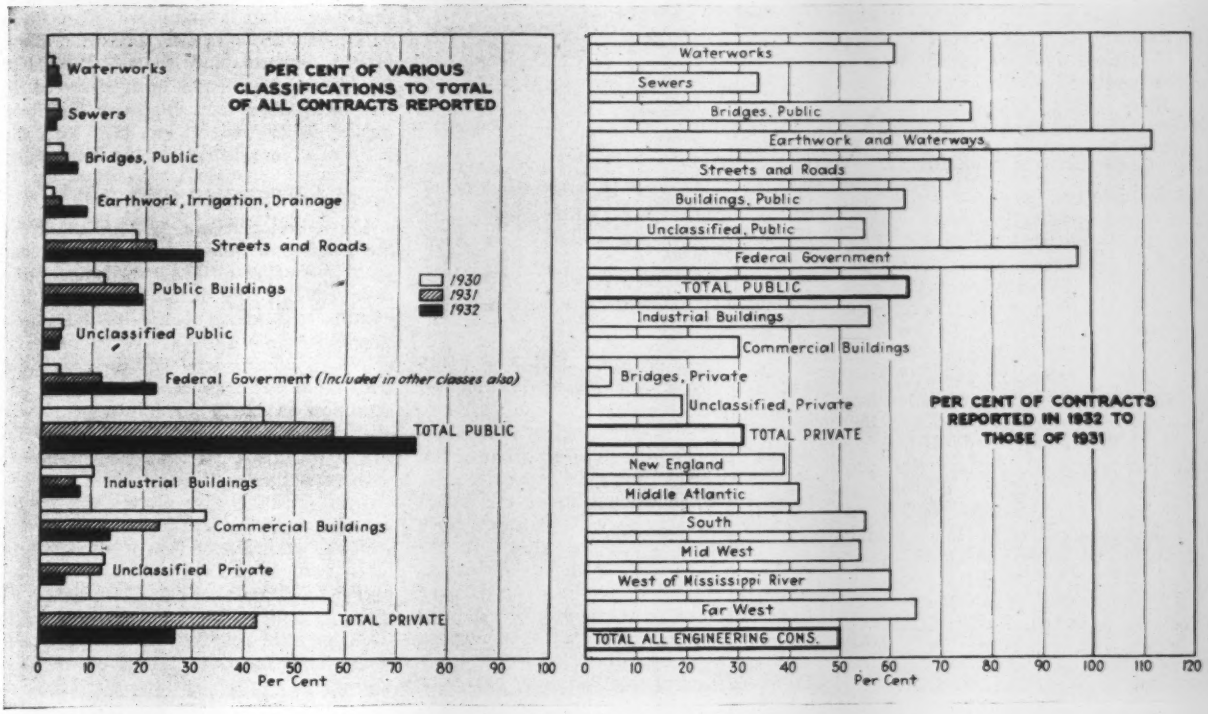


Fig. 5—*Left:* a breakdown of engineering construction contracts into various classes shows relation of each class to total for three-year period. *Right:* but one class of engineering construction, earthwork and waterways, fared better in 1932 than in 1931, all others showing a loss for the year.

The South and Middle West areas showed losses of 45 and 46 per cent, respectively. Construction in the Middle Atlantic states declined 58 per cent from the 1931 total, and a loss of 61 per cent was registered in New England. These ratios are diagrammatically shown in the lower part of the right-hand chart in Fig. 5.

Public works gain in proportion

Public works accounted for 44 per cent of all engineering construction in 1930; in 1930 the ratio had risen to 58 per cent; and in 1932 had increased to 74 per cent, as shown at the left in Fig. 5. Federal contracts likewise gained in proportion to the whole, amounting to 5 per cent in 1930, 12 per cent in 1931, and 22 per cent in 1932. Street and road contracts became increasingly important in 1932, amounting to 32 per cent of all engineering construction work, as compared with 22 per cent in 1931 and 12 per cent in 1930. Public building awards showed a greater increase in proportion to all contracts between the years 1930 and 1931 than in the next year, the ratio being 12 per cent in 1930, 18 per cent in 1931 and 19 per cent in 1932

Building permits low

Great loss of volume in residential building is reflected in the drop in building permits throughout the country. The *Commercial and Financial Chronicle*, reporting permits issued in 354 identical cities, placed the 1932 figure at $417,541,000, as compared with the 1931 permit value of $1,220,800,000, a loss of 66 per cent for the year. As can be seen from the curve in Fig. 3, building permits have steadily decreased in

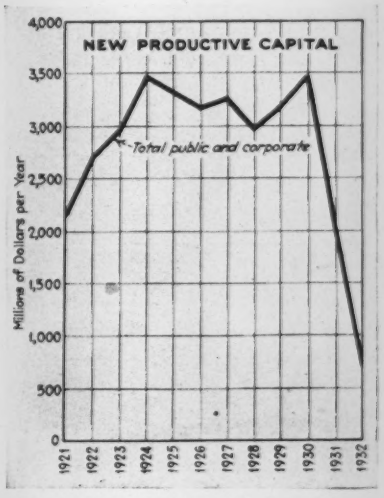


Fig. 6—Construction financing through new productive issues has suffered a decline of 78 per cent in two years.

TABLE III— ENGINEERING CONSTRUCTION CONTRACTS REPORTED BY ENR IN 1932
(Thousands of Dollars)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	Total United States 1932	Total United States 1931	Total Canada 1932	Total Canada 1931
Waterworks	2,053	4,851	1,737	4,150	5,006	16,789	34,586	56,413	5,120	8,066
Sewers	2,129	10,671	1,958	4,151	3,802	1,902	24,613	72,814	1,676	7,172
Bridges, public	3,525	9,606	2,409	14,665	19,462	29,890	79,557	20,638	3,960	4,928
Earthwork and waterways	1,382	8,769	32,907	14,030	27,818	16,345	101,251	125,704	872	3,078
Streets and roads	16,918	62,561	52,256	95,709	103,548	48,945	379,937	528,512	14,626	26,376
Unclassified, public	2,123	14,945	2,546	2,394	2,430	13,576	38,014	84,365	2,763	17,923
Buildings, public	17,142	115,628	22,737	28,501	41,110	15,509	240,627	248,766	5,834	7,909
Total public	45,272	227,031	116,550	163,600	203,176	142,956	898,585	1,418,172	34,851	75,478
Federal government (included in above classifications)	7,388	85,465	55,536	32,717	55,963	33,797	270,866	280,960*	.....	.....
Buildings, industrial	8,373	45,156	5,738	12,486	8,667	12,644	93,064	165,750	6,350	30,732
Buildings, commercial	15,416	107,092	2,971	24,862	9,435	6,520	166,296	560,650	3,954	15,785
Bridges, private	95	1,665	302	235	1,838	140	4,275	11,184	.....	677
Unclassified, private	2,480	22,886	2,254	4,240	13,089	12,140	57,089	298,420	1,461	7,144
Total private	26,364	176,799	11,265	41,823	33,029	31,444	320,724	1,036,004	11,765	53,338
Total — 1932	71,636	403,830	127,815	205,423	236,205	174,400	1,219,309	.....	46,616	.....
Total — 1931	185,616	968,978	234,200	379,951	396,252	289,179	.....	2,454,176	.....	129,816

value each year since 1925, when a total of $4,300,000,000 was reported by these same 354 cities. It is interesting to note that the peak of building permit values came three years before the peak of total construction, reached in 1928.

Construction financing

A long-time low was reached by new-capital issues (productive only) released during 1932, the total being but $720,000,000 as compared with $2,022,000,000 in 1931, a decrease of 65 per cent. Corporate issues for the year were negligible, the total of $159,000,000 being less than 20 per cent of the previous year's value of $787,000,000, which, in turn, was a considerable drop from the 1930 total of $2,032,000,000. State and municipal bonds issued for productive purposes during the past year total $561,000,000, a decrease of 55 per cent from the 1931 value. All state and municipal bond issues sold in 1932 amounted to 841 millions, a decrease of 38 per cent from the previous year; this figure includes not only many refunding issues but also bond sales for relief purposes, an item that reached considerable importance during the year. The total of all financing in 1932 was $1,484,000,000, or 59 per cent less than the 1931 value of $3,627,000,000. Bond sales approved by voters in 1932 amounted to $132,196,000, only 28 per cent of the value of $474,489,000 voted in 1931. Corporate and municipal financing, both total and productive, for the past eight years is shown in Table IV. Fig. 6 shows productive capital issues for twelve years.

TABLE IV — CORPORATE, STATE AND MUNICIPAL FINANCING — EIGHT YEARS
(Millions of Dollars)

	Total Financing, Including Refunding and Funding (Commercial and Financial Chronicle)			New Productive Capital (Moody's Analysis)		
	Corporate	State and Mun.	Total	Corporate	State and Mun.	Total
1925	$4,222	$1,400	$5,622	$1,966	$1,352	$3,318
1926	4,574	1,365	5,939	1,824	1,344	3,168
1927	6,507	1,510	8,017	1,784	1,475	3,259
1928	6,930	1,425	8,345	1,568	1,379	2,947
1929	9,376	1,431	10,807	1,758	1,418	3,176
1930	4,757	1,487	6,244	2,032	1,434	3,466
1931	2,371	1,256	3,627	787	1,235	2,022
1932	643	841	1,484	159	561	720*

*Includes $18,000,000 R.F.C. actual loans for self-liquidating works.

A new factor in financing was introduced in 1932 with the formation of the Reconstruction Finance Corporation. A more complete discussion of the activities of this agency will be found elsewhere in this issue. Although the R.F.C. agreed to finance self-liquidating construction work to the value of over $147,000,000 last year, only $18,000,000 was actually advanced for this purpose and this amount is included in the capital-issue figures.

Funds obtained from gas taxes and motor-vehicle license fees, most of which go into highway construction, have not been definitely evaluated for the past year. Estimates place this value in excess of one billion dollars. Of this amount more than $125,000,000 is estimated to have been diverted to purposes other than highway building, excluding the federal gas tax, with the ratio of diversion constantly increasing.

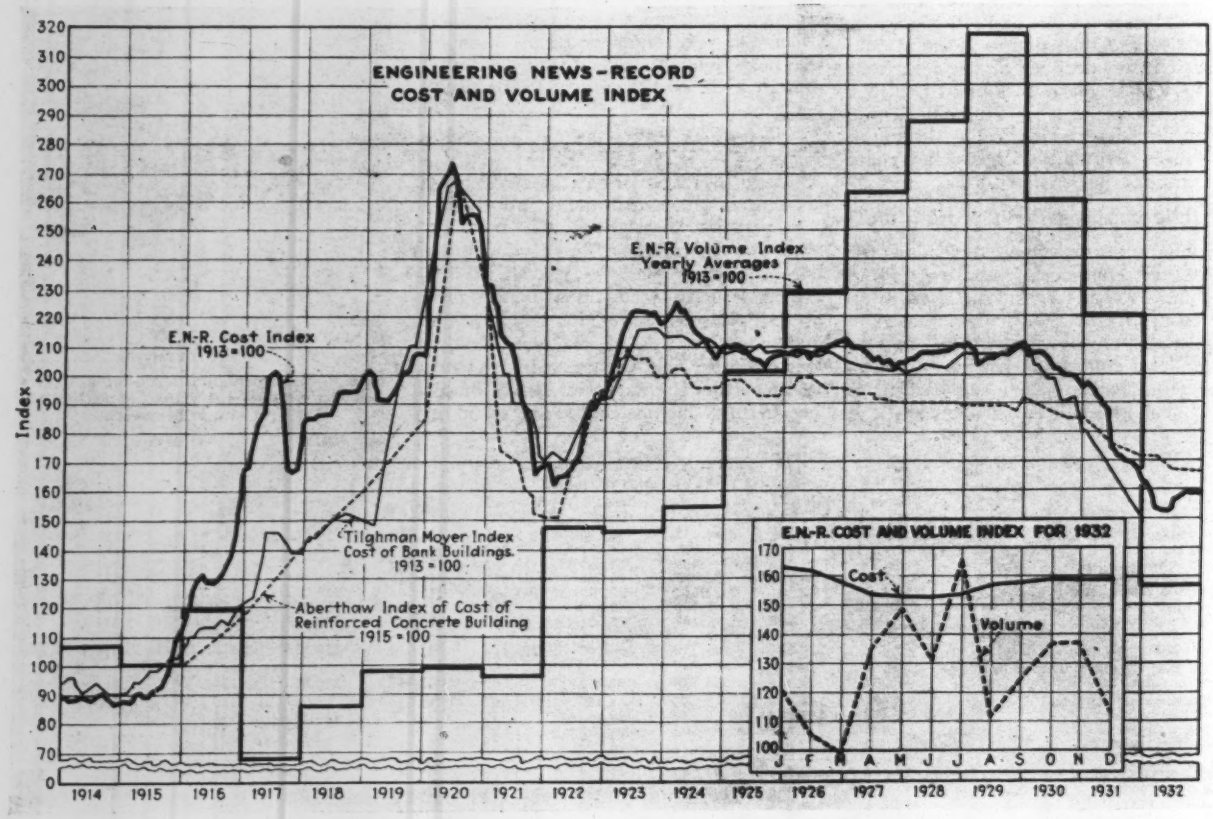
Construction costs rally

Construction costs, as indicated by the *ENR* cost index, reached a sixteen-year low value of 152.2 in June of the past year but rose during the succeeding months to a value of 158.46, the year's average being 156.97. With material prices showing a tendency to stiffen and with labor rates down, the cost of construction is likely to follow a slowly rising trend for the next year or so. In Fig. 7 the *ENR* cost index is compared with two other well-known cost indexes. On this chart is also plotted the yearly averages of the *ENR* volume index, which is an index of yearly construction totals reduced to 1913 costs and referred to 1913 volume as 100. Comparison of the cost and volume curves shows that there is little relation between the volume of construction and its cost.

Unemployment grows

Estimates place the number of construction workers out of a job as high as 80 per cent. Figures of the American Federation of Labor show that the average employment of its building-trades members during the year was 36

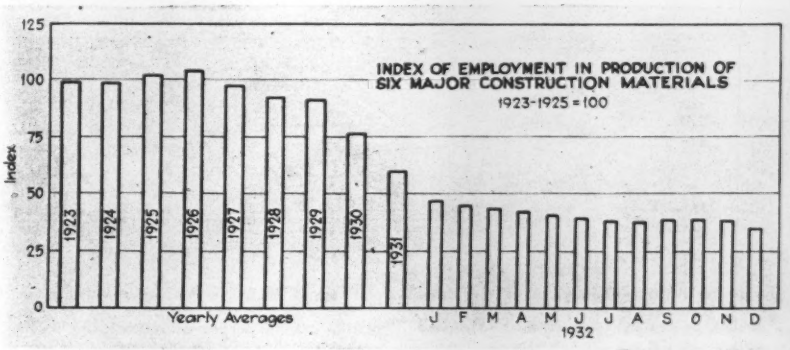
Fig. 7—A two-year drop in construction costs, indicated by the *ENR* Cost Index, was halted last June at the lowest point in sixteen years.



per cent, the ratio being 34 per cent in November. This is in contrast to 68 per cent employment of all A.F. of L. members. An index of construction employment in Ohio, using 1926 as 100 for a base, averaged 33.7 for the year, dropping to 30.6 toward the close. The index of factory employment, using the average of 1923-1925 as 100 for a base, averaged 60 for the year, but showed an increase to 61.2 for November. In the construction field, roadbuilding furnished employment to the greatest number, estimates placing highway contractors' forces at 330,000, with an additional 660,000 indirectly employed in the production of roadbuilding materials and equipment. Table V shows employment statistics for the past five years.

A new index of employment in the production of six construction materials has been started by the Federal Employment Stabilization Board, using the average of 1923-1925 as 100 for a base. This index, extended back to 1923, is shown in Fig. 8. Employment in the production of structural steel, lumber, cement, cast-iron pipe, clay products and steam fittings is considered in making up the index. The index reached a maximum of 103 in 1926 and was at an average of 40 for the past year.

Fig. 8—Employment in the production of construction materials reached its peak in 1926, two years before the peak of the construction volume. Structural steel, lumber, cement, cast-iron pipe, steam fittings and clay products are considered in this index of the Federal Employment Stabilization Board.



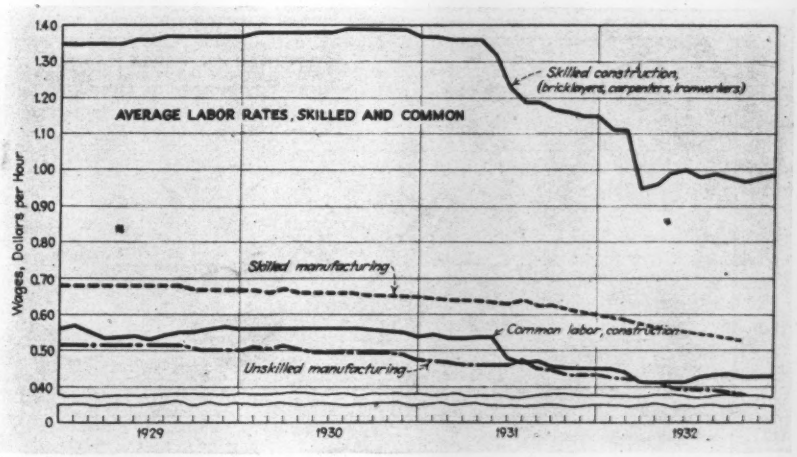


Fig. 9—Construction wages (average of twenty cities) broke sharply in the spring of 1931 and again at the same time in 1932, but recovered somewhat during the last half of the latter year. Manufacturing wages followed a steady decreasing trend since the latter part of 1929.

TABLE V — EMPLOYMENT STATISTICS FOR FIVE YEARS

	Combined Index Factory Employment 1923-1925 = 100	Construction Employment Index Ohio 1926 = 100	All Trade Unions, Per Cent Employed	Building Trades, Per Cent Employed
1928 Aver.	97.2	106.8	87	73
1929 Aver.	101.1	109.1	88	75
1930 Aver.	87.8	85.1	79	60
1931 Aver.	74.4	54.8	74	48
1932-Jan.	68.1	31.9	69	38
Feb.	67.8	28.4	69	37
March	66.4	26.7	70	37
April	64.3	31.0	69	35
May	62.1	33.3	69	39
June	60.0	36.3	68	38
July	58.3	37.8	66	36
Aug.	58.8	37.9	67	36
Sept.	60.3	40.8	68	35
Oct.	61.1	35.7	69	35
Nov.	61.2	30.6	68	34

Based on the average of rates paid in twenty cities throughout the country, skilled construction wages showed a considerable decline in 1932, while common labor rates held fairly steady. The average rate of three skilled trades (carpenters, bricklayers and ironworkers) was $1.15 per hour at the beginning of the year, but it dropped to 94c. in three months, due to abandonment of union scales in many centers. This rate stiffened during the summer, closing the year at 99c. Common labor rates fluctuated less, opening the year at 45c. per hour, dropping to 41c. during the summer and closing the year at 43c. Both of these trends are in contrast to general manufacturing wages, which have shown a slow but steady decline since the middle part of 1929, the rate of decline increasing during 1932. Construction and manufacturing wages, both skilled and common, are plotted for a four-year period in Fig. 9.

Production of materials

Production of construction materials declined with the drop in construction volume. Timber production, for example, in 1932 amounted to less than ten billion bd.ft. for the first time in 60 years. However, production figures of the lumber industry are not the true indication of business done in 1932, as cutting was curtailed considerably in an effort to reduce the huge stocks on hand at the mills. Production of soft woods, which comprise by far the greater proportion of all lumber output, was in 1932 about 59 per cent of the 1931 cutting, while soft-wood shipments in 1932 were 67 per cent of the 1931 amount, and new

TABLE VI — PRODUCTION AND SHIPMENTS OF VARIOUS CONSTRUCTION MATERIALS

	1932	1931	1932 to 1931 Per Cent
Face brick:			
Shipments, average per plant, thousands	2,534	5,388	47
Sand-lime brick:			
Shipments, thousands	28,600	64,500	44
Cement:			
Production, thous. bbl.	76,509	124,570	61
Shipments, thous. bbl.	80,579	126,465	64
Stocks, end of year, thous. bbl.	20	24	84
Explosives:			
New orders, thous. lb. (11 mos.)	139,102	282,077	71
Production, thous. lb. (11 mos.)	196,509	289,304	68
Shipments, thous. lb. (11 mos.)	197,380	292,281	68
Lumber, Soft woods (identical mills):			
Production, million bd.ft.	5,045	8,517	59
Shipments, million bd.ft.	6,218	9,253	67
New orders, million bd.ft.	6,185	8,932	69

	1932	1931	1932 to 1931 Per Cent
Gypsum products:			
Plaster board, partition tile, etc. Shipments, thous. sq.ft. (9 mos.)	281,274	460,532	61
Keene's cement, plasters, etc. Shipments, thous. tons (9 mos.)	698	1,257	55
Steel ingots:			
Production, thous. tons	13,096	25,193	52
Fabricated structural steel:			
Bookings, thous. tons (11 mos.)	802	1,783	45
Shipments, thous. tons (11 mos.)	874	1,689	52
Fabricated steel plate:			
New orders, tons (11 mos.)	151,592	286,067	53
Prepared roofing:			
Shipments, thous. squares (11 mos.)	22,402	21,587	104
Terra cotta:			
New orders, tons (11 mos.)	15,129	40,548	37

TABLE VII — OUTPUT OF VARIOUS CONSTRUCTION MATERIALS FOR TEN-YEAR PERIOD

	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1932 to 19 Per Ce
Cement shipments, thous. bbl.	135,888	145,753	156,720	161,784	170,928	175,452	169,440	159,588	126,465	80,529	64
Sand-lime brick, shipments, thous.	.....	.....	.....	.....	205,080	205,320	172,644	102,552	64,500	28,600†	44
Face brick shipments, average per plant	10,800	13,248	13,284	13,512	13,200	12,948	11,964	8,496	5,388	2,534†	47
Explosives, shipments, thous. lb.	438,504	412,080	410,892	436,332	406,044	396,468	438,852	380,892	310,368	217,380*	69
Steel ingot production, thous. tons	43,486	36,811	44,141	46,936	43,777	50,325	54,850	39,595	25,193	13,096	48
Fabricated structural steel shipments, thous. tons	2,440	2,657	2,998	3,218	2,854	3,122	3,307	2,987	1,812	944*	48
Fabricated steel plate, new orders, thous tons	610	362	389	516	500	628	639	569	303	159*	47
Prepared roofing shipments, thous. squares	.....	.....	.....	.....	.....	36,540	39,864	27,876	22,592	22,787*	101

*December, estimated. †November and December, estimated.

orders were 69 per cent of the previous year's value.

Structural steel shipments amounted to only 48 per cent of the 1931 volume. The production of steel ingots was on about the same basis. Cement, however, showed up somewhat better in output, shipments of 80.5 million bbl. in 1932 representing 64 per cent of the 1931 business. Brick sales were low, the year's shipments of the sand-lime and face-brick classes amounting to 44 per cent and 47 per cent, respectively, of those of the previous year. Tables VI and VII show further statistics of the production of construction materials. Production of steel, cement and lumber, on a basis of production in per cent of capacity of the industry, is shown in Fig. 11.

Prices of materials

It is generally conceded that during the past year prices of many construction commodities were below cost of production. Obviously such a condition is ruinous, and one or two of the major construction commodities, including cement, were pulled out of the low-price rut in the last half of the year. A four-year price trend of lumber, cement and steel, each shown for one market, is shown in Fig. 10. Lumber at New York declined from $62.50 in 1929 to a low of $38 in mid-summer of 1932, increasing to $40 in the fall and closing out the year at $39. Cement prices in the Chicago market, while far from recovering from the severe slashes of early 1931, managed to show a substantial increase toward the end of the year. Structural steel prices have held the steadiest of any of the basic commodities. During the last half of 1932 prices at Pittsburgh were steady at $1.60 per 100 lb. after seven months at a low price of $1.50.

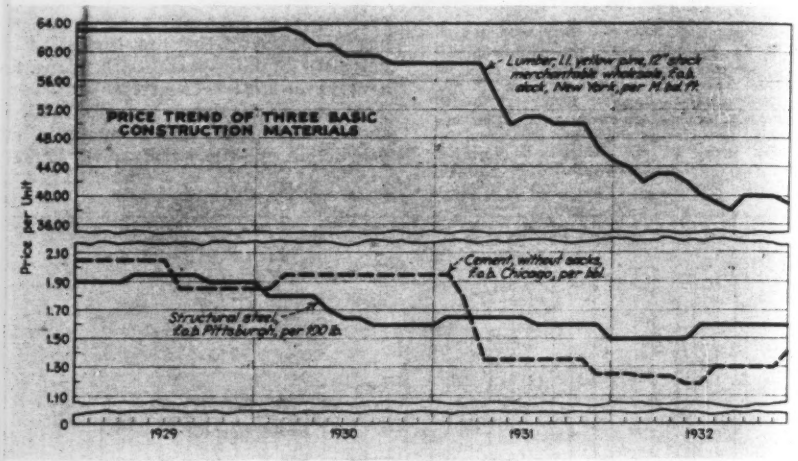


Fig. 10 (above)—The price of the three basic construction materials reached long-time lows in 1932, but stiffened somewhat during the last six months. Indications are that they will not go lower.

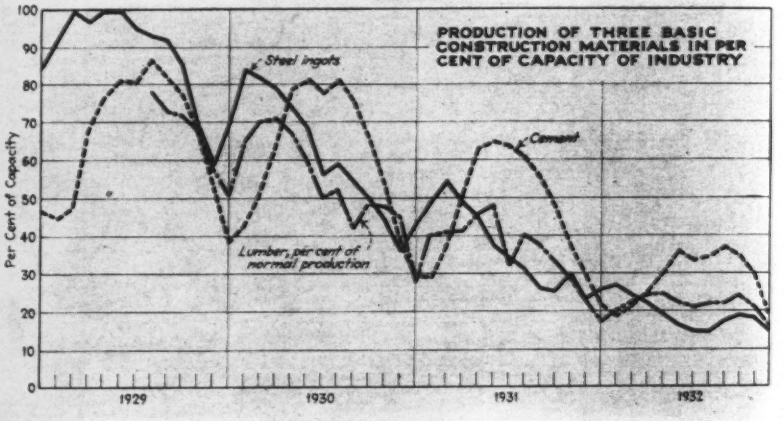


Fig. 11 (below)—Production of the three basic construction materials has followed the general decline of construction volume during the past three years. The chart shows the seasonal trend of each material.

Construction Budget for 1933 Estimated at 90 Per Cent of 1932 Volume

ESTIMATING the construction budget for 1933 has few reliable data to rest on. The financial condition of many states and cities is a large factor of uncertainty. Highway building is sure to face a decrease this year unless some measure of emergency federal aid comes to the rescue. Gas taxes and license fees, long the main support of highway building, are threatened with increasing diversion almost daily as state legislatures frantically seek means to fill badly depleted treasury coffers. Railroads and other utilities are curtailing construction budgets to the absolute minimum, and not much hope for increased activity can be looked for in that direction. Reports from a number of cities indicate municipal construction expenditures will be reduced about 13 per cent from the 1932 totals. Federal expenditures, committed until the end of the fiscal year June 30, are expected to be maintained throughout the year.

On the brighter side of the picture is increased hope from R.F.C. loans. Bridges and waterworks will undoubtedly increase during the current year if a majority of R.F.C. commitments result in actual contracts. Industrial building construction has shown a tendency to increase during the past few months, and the slightest improvement in general business conditions will bring forth additional projects and betterments now being held in abeyance.

A broad analysis of construction conditions today indicates that we are at the minimum of construction requirements of the nation and that there cannot be much reduction. On this basis and by further analysis of the status of each class of construction we arrive at the conclusion that the 1933 construction budget will be about 90 per cent of the 1932 volume, or a total for the country of $2,500,000,000.

Trends of Activity in Leading Industries

Vital statistics of a selected group of industries whose conditions of sickness or health largely influence the course of construction

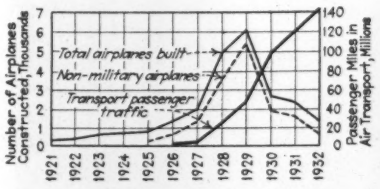
◆ ◆ ◆

CONSTRUCTION prospers as the rest of business prospers, and it lags when business and industry are depressed. A picture of what industry has been doing should therefore be instructive. When some of the leading industrial groups are isolated from the general picture, as is done here, it is noted that some have fared better than others, that in some lines there has been positive improvement and that in most there is evidence that a bottom has been reached or passed. The short surveys of some of the important industrial groups follow.

Aeronautics

AVIATION has changed front in the last two years. From a manufacturing industry with a latent hope of supplying every man with his own airplane, it has been transposed into a branch of transportation. Operation has gained the focus of attention, and construction of airplanes has receded. In 1932, for the first time, the total revenues of American air-transport lines exceeded the total sales of airplanes and engines, including the military. The airplane industry has been as drastically deflated as most other lines of manufacturing. Air transport, on the other hand, has the rather extraordinary record of steady advance to ever higher levels throughout the depression. At the present time airplanes fly 140,000 miles a day on regular schedule under the American flag. For 1933 it seems probably that air-transport growth will exceed the total of all other aeronautical activities.

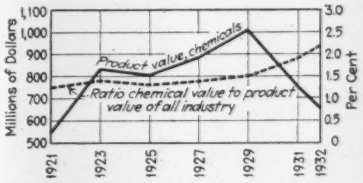
Technical progress in the industry has continued to move forward; after slowing up during the boom years following 1925 it has shown unmistakable signs of acceleration within the past eighteen months.


Number of Airplanes Constructed, Thousands
Passenger Miles in Air Transport, Millions
Total airplanes built
Non-military airplanes
Transport passenger traffic
1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932

Its war-baby days gone, its aspiration to emulate the automobile industry deflated aviation turned to transport and produced the only steeply rising curve in the industrial picture.

Chemical Industry

THREE fundamental characteristics of the chemical industry—namely, its relative youth, the diversity of its markets and an intimate relation to research—have helped it to resist the general downward trend of all industry since 1929. In the period covered by

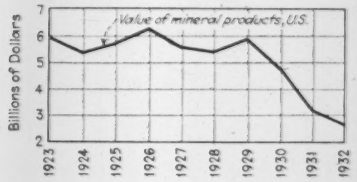

Millions of Dollars
Per Cent
Product value, chemicals
Ratio chemical value to product value of all industry
1921 1923 1925 1927 1929 1931 1932

Flexibility of the youthful chemical industry has permitted it to adapt itself rapidly to changing industrial conditions. Gradually but consistently it has become a larger part of total industry as measured by the value of its products.

the accompanying graph, this more rapid growth is shown by the climbing ratio of the value of the products of chemical industry as compared with the total for all manufacturing. The consistent rise in this ratio since 1925 is perhaps best explained by the creative influence of chemical research and development, which has given the industry an inherent flexibility and permitted it to adapt itself quickly to changing industrial conditions. However, as we go farther into this depression—or approach nearer to its end—there is a lagging tendency on the part of the heavy chemical industries that serve principally iron and steel, construction and agriculture, while the lighter or fine chemical industries that produce consumer goods show a much smaller decline.

Mining

IN THE first seven years of the last decade the mineral industries continued their rapid growth, a growth that during the twenty years ending in 1929 far outstripped agriculture, manufactures and rail transport. In the last three years, however, both mineral output and value declined sharply. The accompanying curve, based on the annual total valuation of mineral production, should not be taken as an exact indicator of industrial performance, inasmuch as values do not fluctuate in complete accord with output. An *estimate* of the total value of mineral products of the United States in 1932 is

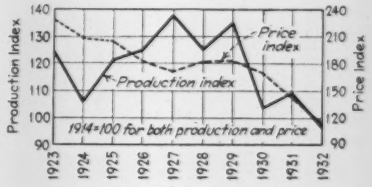


In common with other industries, dollar value of mineral products in the United States (metal, non-metal and fuel) has declined appreciably.

$2,600,000,000, or 18 per cent below the total value for 1931.

Textiles

FROM the standpoint of mill operation, the textile industry has fared far better during the last two years than has industry in general. In 1932, for example, total activity as shown by raw-material consumption was only 11 per cent below 1931 and only 19 per cent

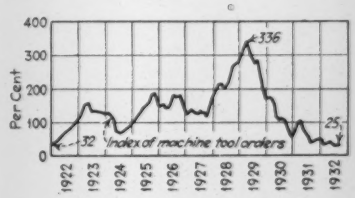

Production Index
Price Index
Price index
Production index
1914=100 for both production and price
1923 1924 1925 1926 1927 1928 1929 1930 1931 1932

Compared with many industries, decline in textile production in 1932 was slight. *Textile World's* price index reveals the abrupt drop from the period of inflated raw-material prices.

below the average for the preceding eight years. A sudden pick-up in demand last summer necessitated almost capacity operations during the last five months of the year. Fairly well-maintained demand is anticipated for at least the first few months of 1933; prospects beyond that period depend largely upon the course of general business.

Metal-Working

DURING the past decade the metal-working industry has experienced the greatest peace-time boom of record

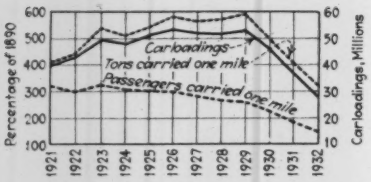


Index of machine-tool orders reached record low point for the past decade in 1932. At a value of 25.3 it represented only 7½ per cent of its peak value in 1929.

and the worst depression. Comprehensive statistics of the industry as a whole are not available, but as the builder of the machinery for a machine civilization its importance is obvious. Typical of the industry is the activity graph of the machine-tool-building group. Note that the sales of this group varied from a maximum index number of 336 in 1929 to a minimum of 25.3 in 1932. This chart is significant because its humps and valleys correspond very closely in point of time to the ups and downs of the general business curve. Recovery is now apparently under way.

Railroads

TOWARD the end of the year there were indications that the steady decline in railroad traffic that has been in progress since the beginning of 1930 had been checked. Contrary to 1931, revenue freight-car loadings rose fairly steadily from mid-July to mid-October, the period when a decrease in loading is to be expected. Since October the



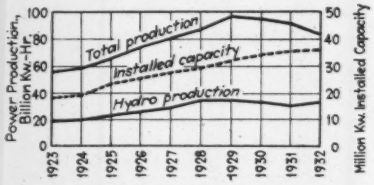
Railroad car loadings, being one of the best of business barometers, are down some 50 per cent from the peak. Recently they have shown some stability. Passengers, by their absence in growing numbers, accentuate the railroads' difficulties.

falling off has been less pronounced so that in November, instead of handling less freight than in July, as has been the case for the past five years, the railroads were handling more. This uptrend is considered by railroad men to be indicative of better business in 1933. On the other hand, revenue ton-miles and passenger-miles are far below normal. Despite notable economies and a reduction in wages, a few railroads have gone into the hands of receivers, and 61 of the Class I railroads failed to earn expenses and taxes in the first eleven months of the year. The net operating income of all Class I roads in the same period was $301,000,000, or 1.2 per cent of their property investment.

Maintenance expenditures for the year 1932 were cut to $355,000,000 from an average of $850,000,000 for the five years 1923-29.

Electric Power

TOTAL electric energy produced in 1932 is estimated at 83,000,000,000 kw.-hr., a decrease of about 10 per cent over 1931. Of the total, 34 billion kw.-hr. was produced by hydro-power plants and 49 billion by fuel-power plants. The hydro-power total represents an increase of 10 per cent over 1931, while the fuel-power figure represents a decrease of 18 per cent. This remarkable reversal in trend for hydro-power is in large measure due to the ending of the drought that had seriously affected many plants. But it is also due in part to



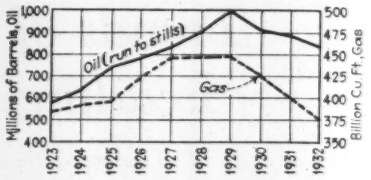
Hydro power jumped up 10 per cent, fuel power down 18 per cent in 1932. Total energy produced was off 10 per cent.

the fact that companies owning both hydro and fuel plants are continuing to carry as much load as possible on the hydro units. This explains, in addition, the decrease in fuel power, a decrease that has gained in momentum since 1929.

There is an excess of utility station capacity of about 25 per cent, caused almost wholly by sag in industrial demand. An excess capacity of 10 per cent is normal. In 1932 about 600,000 kw. was added to the country's installed capacity.

Gas and Oil

PETROLEUM run to stills in 1932 was down less than 10 per cent from the preceding year—a favorable record compared with the large decreases in most industries. And since consumption



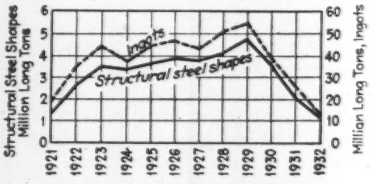
Petroleum refined annually is down 15 per cent from its peak. Gas consumption has a similar record, but largely as a result of a decline in the use of natural gas. Manufactured gas on the other hand has suffered a decline of only about 5 per cent.

of about 870,000,000 bbl. exceeded production by some 80,000,000 bbl., the industry improved its statistical position.

City gas requirements declined less than almost any other division of industrial activity. Household and commercial use declined less than 5 per cent, and industrial use only a little more than this in the case of manufactured gas, but as much as 15 per cent in the case of natural gas.

Steel

INGOT production was down 50 per cent, price down 5 per cent and a loss per ton rising from $8 in the first quarter to $18 in the last quarter of the year. In round numbers that is the record of the steel industry in 1932. In spite of



In both price and volume steel has returned to the gay nineties. Basic as it is, the steel industry depends on autos, construction and the railroads, whose purchases have been greatly reduced.

the large drop in motor-vehicle manufacture, the automobile maker was the steel industry's best customer, replacing construction, which had occupied first place in 1930 and 1931. Autos accounted for 18 per cent of the steel used, construction for 16 per cent, containers for 11 per cent, railroads for 9 per cent and pipe for 6 per cent.

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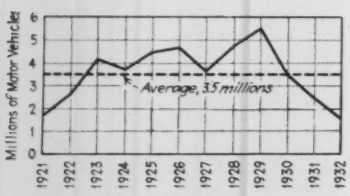

MOTOR-VEHICLE PRODUCTION in 1932 was about 1,430,000 units, less than half the average of the past twelve years. Manufacturers hope replacement demand will start a rising cycle in 1933.

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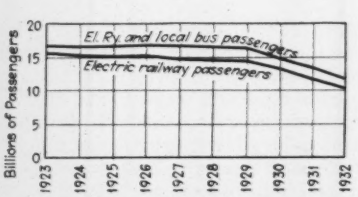

TRANSIT in our cities has suffered a 27 per cent loss in passengers in the last three years. Bus passengers, while increasing in numbers, are still a small per cent of the total transit load.

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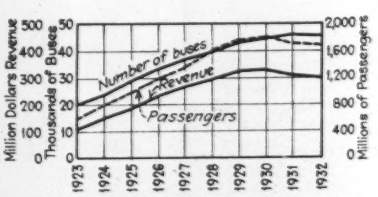


PUBLIC-CARRIER BUSES, both local and long distance, have suffered only a 5 per cent loss in both passengers and gross revenue from the peak year of 1930. Total buses in service have not declined.

Progress Made on Large Engineering Projects

Municipal Water-Supply Systems

Hetch Hetchy Water Supply—San Francisco may be drinking its long-awaited Hetch Hetchy water by the end of the year. Less than 2 miles of the 28-mile Coast Range tunnel remains to be driven, and all other features of this extensive water-supply system to deliver a gravity supply from the high Sierra to the city have been completed. During 1932 the 47-mile pipe line across the San Joaquin Valley, connecting the west end of the Foothill tunnels with the east portal of the Coast Range bore, was completed. This line consists of a 60-in. steel pipe laid in trench. Upper units of the system, including the main O'Shaughnessy storage dam and the Moccasin Creek power development, have been completed and in operation for several years.

✦

Bouquet Canyon Dam—About 2,800,000 cu.yd. of rolled earthfill will be required for the 215-ft. Bouquet Canyon Dam being built by the Los Angeles Department of Water & Power near the Owens Valley aqueduct line for municipal storage and power regulation. Construction operations are being carried out by the forces of the department.

✦

Colorado River Aqueduct—Progress to the stage of active construction, through the aid of R.F.C. financing, was the record of the Metropolitan Water District during the past twelve months in starting the $200,000,000 Colorado River aqueduct project. The development will provide for conveying an ultimate diversion of 1,500 sec.-ft. from the river to Los Angeles and the adjacent cities comprising the district. A contract has been let for the $7,000,000 San Jacinto tunnel, 13 miles long, the longest on the aqueduct line. In addition, bids have been called on other tunnel units and, as an unemployment relief measure, the district has undertaken extensive tunneling operations by force account. The aqueduct line is 226 miles long and involves a static pumping lift of 1,583 ft. Tunnels aggregate 84 miles of the distance, and the aqueduct is designed for a 1,605-sec.-ft. capacity. The construction program will occupy about six years.

✦

Pine Canyon Dam—Concrete placing by cableway and buckets is advancing rapidly on the Pine Canyon Dam, being built by the Pasadena (Calif.) Water Department on the San Gabriel River to provide 40,000 acre-ft. of storage. The structure is of gravity design, 325 ft. high from the foundation and will contain 430,000 cu.yd. of concrete. Following the award of contract in April, 1932, a delay was occasioned by a suit to determine the jurisdiction of the state act for prevailing wages over the municipality. Following settlement of this question, work was rushed at a rapid pace and concrete placing was begun early in September. Special low-heat cement is being used.

✦

El Capitan Dam—The 1,150-ft. horseshoe-shaped tunnel 25 ft. in diameter, to be used for diversion and permanent outlet, has been completed and construction operations are well advanced on the El Capitan Dam, which is being built by the city of San Diego as an addition to its water-supply system. The structure will provide 118,000 acre-ft. of storage on the San Diego River. Subsequently an aqueduct line will connect with the present municipal water-supply system. The 240-ft. dam will be principally hydraulic fill but will have rock embankments on both faces and arched concrete toe dams to resist spreading.

✦

Vancouver Water Tunnel — The 3,100-ft. tunnel under the First Narrows of Vancouver harbor, being built by the Greater Vancouver Water District as an improvement of the Capilano River supply system, is scheduled for completion by June. The two 400-ft. shafts have been completed and the tunnel driven. Lining operations are well advanced.

✦

Denver Water Supply—Because of a threatened water shortage in Denver, acceleration of the work of lining the pioneer bore of the Moffat tunnel was decided upon, and bids were called on Jan. 10 of this year on 15,000 ft. of 7-ft. steel pipe for installation between the intake shaft and the apex. Lining work in the tunnel has been carried on slowly since the water department took over the tunnel in 1929. Bids for the steel pipe were not opened, and new bids are expected to be called. It is hoped to be able to divert water from the west slope by June.

✦

New Water Tunnel, Chicago—In the driving of the Chicago Ave. water tunnel at Chicago, there remained to be done at the end of 1932 8,586 ft. of the 41,321 ft. of 16-ft. tunnel, 6,118 ft. of the 9,838 ft. of 13-ft. tunnel and 6,814

Cobble Mountain Dam and Reservoir, new water supply for Springfield, Mass. The dam is 250 ft. high, a semi-hydraulic earthfill with rockfill at the toe. A hydro-electric power plant and additions to the city's filtration plant and distribution system are included in the project.

ft. of the 9,292 ft. of 10-ft. tunnel. Lining still remains to be done on 23,460 ft. of the 16-ft. tunnel and all of the 13-ft. sections and 7,558 ft. of the 10-ft. sections. Practically all the tunnel driving will be completed in 1933, and all of the lining together with 50 per cent completion of shafts and tunnel connections at Central Park Ave. pumping station, and full completion of connections at Chicago Ave. station. On this 11½-mile tunnel the construction in 1932 was carried on at the new crib and from five construction shafts. The work is being done by day-labor forces.

New Chicago Pumping Station—Having obtained $2,300,000 of R.F.C. funds late in 1932 for a pumping station at Harrison St. to replace three obsolete stations at Harrison St., 14th St. and 22nd St., the city of Chicago has detailed plans in preparation.

✦

New York City Water Supply—The 20-mile water tunnel No. 2, extending from Hill View reservoir in Yonkers through the boroughs of the Bronx, Queens and into south Brooklyn, was holed through during the past year. Practically all lining of the tunnel has been finished except short stretches at shafts 8, 9 and 10. Many of the shafts have been completed with permanent lining and installation of riser pipes and caps. All work on the $43,000,000 main tunnel and shaft contract will be completed by October of this year. The tunnel cannot be placed in service until valves and operating equipment have been installed. Letting of contracts for this work, involving about $1,000,000, has been postponed until the financial condition of the city improves, though bids were received about a year ago. Development of the proposed Delaware River supply is at a standstill.

✦

Boston Water Supply—The Metropolitan District Water Supply Commission is progressing with its plan to increase the water supply of Boston and environs by diverting waters of the Ware and Swift rivers into the present Wachusett Reservoir. The Ware River intake works and the 13.2-mile tunnel for diverting floodwaters of the Ware have been in operation for the past two spring flood seasons. The extension of the tunnel 11.4 miles westerly to complete the Quabbin aqueduct to the Swift River is now under construction. A length of 3.1 miles remains to be excavated and 10.4 miles to be lined. For the proposed Quabbin reservoir on the Swift River about 75 per cent of the necessary real estate has been acquired, and more than 5 miles of relocated highways built. At the site of the main dam on the Swift River an earth embankment to raise the water level 150 ft. and a 1,000-ft. diversion tunnel are practically complete. For the Quabbin dike, nearly as large as the main dam, contract has just been let for the sinking of 27 pneumatic caissons through 125 ft. of water-bearing sand, gravel and boulders to bedrock to form a concrete corewall for the earthfill.

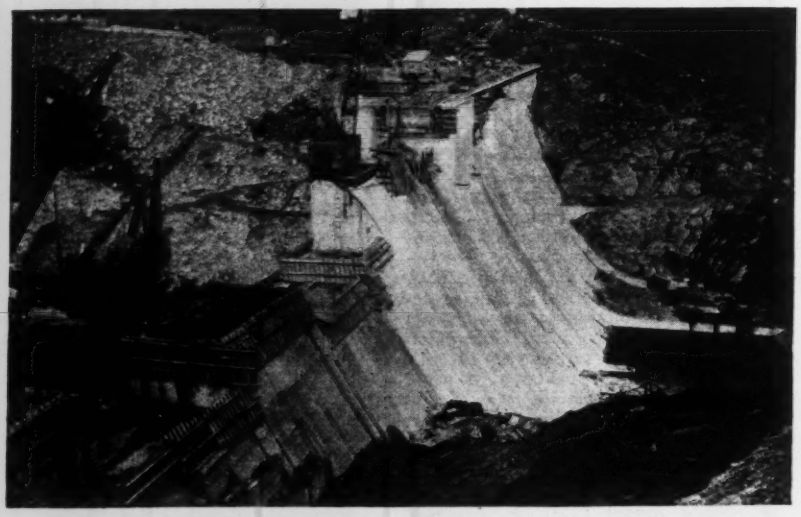
✦

Albany Water Supply—The first stage of the new gravity water supply for the city of Albany, N. Y., was completed during the year 1932. The former pumped supply from the Hudson River was discontinued during the month of November when the new mountain supply was gradually introduced to the city. The first stage of the new supply includes Alcove Dam and Reservoir on Hannacrois Creek, a tributary of the Hudson; a diversion dam and tunnel from Basic Creek to the Hannacrois watershed; about 20 miles of 48-in. cast-iron conduit; a 32-m.g.d. filtration plant and a distribution reservoir at Loudenville. The first stage can be supplemented in the future through the construction of the second and third stages.

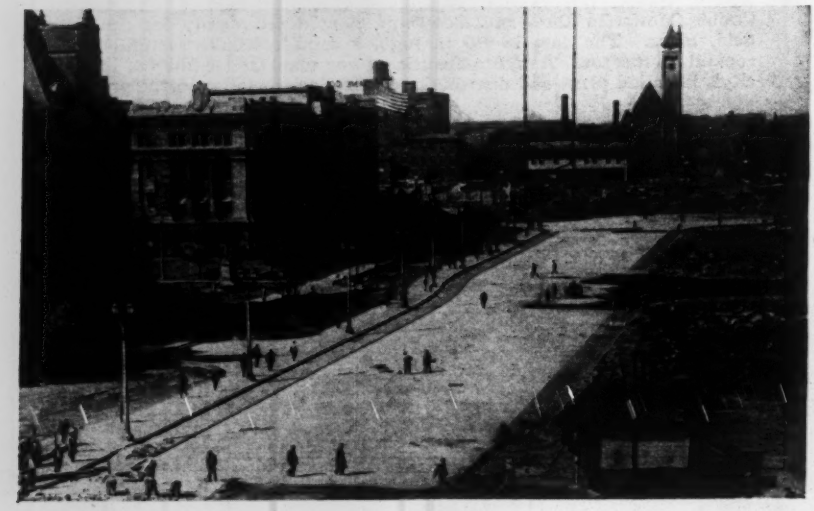
✦

Madden Reservoir, Canal Zone—Contract for the construction of Madden Reservoir on the Chagres River to add to the water supply of the Panama Canal was let in November, 1931. The work includes Madden Dam, a large concrete structure, and fifteen earth and rockfill dams, also a power house. At the close of the year work on one end of the main dam was well along, including work in the cofferdam in the river channel. Ten of the smaller earth and rockfill dams had been completed, and work was well along on the others. The proj-

Prettyboy dam, which is being built by the city of Baltimore to add 20 billion gallons storage capacity to its water system. The new dam is on the Gunpowder River, above the existing Loch Raven dam. It is of the concrete, gravity type, 150 ft. high and 730 ft. long and will cost $2,500,000. Construction has been delayed by poor rock conditions at one abutment, requiring much additional excavation and some changes in plans, and by failure of the original contractor.



Market St. widening at St. Louis, looking west from the Civil Courts building past the City Hall (with flag) to the new $3,500,000 auditorium. At the right is part of the seven-block area from which the old buildings are being removed to make a plaza. Work on the new Natural Bridge thoroughfare and widening, repaving and raising the grade of Market St., at a cost of $1,250,000, has been carried forward to relieve unemployment in the city.



ect is scheduled for completion late in 1934.

✦

Alexander Dam, Hawaii — Alexander Dam, for the McBryde Sugar Co. in Hawaii, an earthfill structure 140 ft. high, was completed in March. Construction of a 50-ft. toe dam was begun in August, 1928, and the main dam was begun in May, 1929. A major slide that occurred in March, 1930, required some changes in design and almost complete reconstruction.

Hydro-Electric Power Development

Beauharnois Power and Navigation Project—Delivery of power from the Beauharnois station began at midnight of Sept. 30, 1932. Early in the fall, water was admitted into the 15-mile canal which diverts a portion of the flow of the St. Lawrence River from Lake St. Francis and returns it to that stream at the power plant located on Lake St. Louis above Montreal, P. Q. The machinery at present installed includes two 8,000-hp. station auxiliaries, two 50,000-hp., 25-cycle, and two 50,000-hp., 60-cycle units. Ten additional 50,000-hp. units may be installed without extension to the power house. Railway and highway bridges over the canal have been finished and put into service. Canal excavation and diking required for the initial power contracts is finished. The project is so designed as to permit progressive expansion to the stage at which the entire flow of the river will be diverted through the canal for the production of approximately 2,000,000 hp.

The project is one link of the proposed St. Lawrence deep waterway, and navigation can be added at will by the construction of locks near the power house.

✦

New-Kanawha Power Project — The Hawks Nest hydro-electric development on the New River, just above its junction with the Gauley and Kanawha rivers in West Virginia, is expected to go into operation this year. The project consists of an overflow-type dam, 60 ft. high, a pressure tunnel through rock, 16,250 ft. long, and varying in diameter from 30 to 46 ft., and four power units of 30,000 kva. each, together with an intermediate surge basin, a surge tank and penstocks. The dam is about completed. Lining is progressing favorably on the pressure tunnel, all excavation for the tunnel having been finished. The penstocks are now being installed. Three of the power units are being placed at present. The powerhouse structure is complete.

✦

Rapide Blanc, St. Maurice River, Quebec — The main dam and power house of the 240,000-hp. development of the Shawinigan Water & Power Co. at Rapide Blanc on the St. Maurice River in Quebec was completed early in the year, and installation of the turbines and generators is expected to start in the spring. Work on a side dam and the elevation of the C. N. Railway tracks is under way.

NEW FEDERAL BUILDINGS UNDER CONSTRUCTION IN WASHINGTON

Curtis-Wright Aerial Survey

Many of the new buildings completed or under construction as part of the great building program of the federal government are shown in this air view of Washington. Facing the Capitol, in the right center foreground, is the Supreme Court Building; to the right of that is the new Senate office building, and opposite it, at the south side of the Capitol grounds, is the enlarged House office building and the new House office building. Midway between this building and the Potomac the tall building standing alone is the federal warehouse, and about midway between it and the Washington Monument is the Department of Agriculture Building. Opposite the latter, at the north side of the monument grounds, is the great building for the Department of Commerce. In the triangular area between Pennsylvania Ave. and the Mall, in advance of the Commerce Building, the steelwork for the Interstate Commerce Building and the Department of Labor Building shows indistinctly. Next is the Internal Revenue Building, and in front of it is the steelwork for the Department of Justice Building. Other new structures of interest are the Arlington Memorial Bridge, to the left of the monument, and the Botanic Garden conservatory in the Mall southwest of the Capitol. New private buildings are the Folger Shakesperian Library, adjoining the Library of Congress in the foreground, and the Standard Oil Co. of New Jersey Building midway between the Senate office building and the Internal Revenue Building.

Bridge River Development—Work on the development of the Bridge River in British Columbia, a 600,000-hp. development to be carried out in successive stages, was suspended with the completion of the lining of the 14-ft. tunnel, 13,200 ft. long, to divert the river to a 1,300-ft. head plant on Seaton Lake.

✦

Abitibi Canyon—Work on the project to develop 330,000 hp. on the lower Abitibi River in Northern Ontario through the construction of a high concrete dam across the canyon flanked by low earth dams was discontinued in July because of financial difficulties. The Ontario government has taken over the project and is expected to complete it as part of the Ontario Hydro-Electric System, installing two of the proposed five 66,000-hp. turbine generators.

Chats Falls, Ottawa River — The 224,000-hp. development astride the Quebec-Ontario boundary in the Ottawa River, 20 miles above Ottawa, was completed during the year. The power house is on the interprovincial boundary with four 28,000-hp. units of the Hydro-Electric Power Commission on the Ontario side and four similar units of Ottawa Valley Power Co. on the Quebec side. Space for one more unit in each province is provided.

✦

Masson Falls, Lievre River, Quebec—The dam and one-mile pressure tunnel for the 130,000-hp. Masson Falls project on the Lievre River at Masson, Que., were completed during the year, and work on the power house has progressed to the point where the plant is expected to begin operation in July, 1933.

Sewage Treatment and Drainage Systems

Louisville Sewers—The city of Louisville, Ky., is finishing up an extensive sewerage system authorized by three bond issues voted in 1919, 1924 and 1928, totaling $17,000,000. A feature of this system is the Southwest outfall sewer, 4 miles long, varying in inside dimensions from 15ft.8in.x23ft. to 18ft. 4in.x27½ft. The first section of this large sewer is practically complete. Contract was awarded late last fall for the second section. Most of the other sewer lines in the new system have been completed.

✦

Duluth Sewage Program—The first step in a comprehensive sewage-treatment program for Duluth, Minn., is now in progress. Collection of 90 per cent of the sewage from this narrow city, extending in a narrow 1-mile strip for nearly 30 miles along Lake Superior and St. Louis Bay, and treatment at a central plant in St. Louis Bay 3 miles upstream from Lake Superior is contemplated. Preliminary-tank treatment followed by chlorination is to be provided. For the first step $750,000 is now being spent for an intercepter and a pumping station building.

✦

Milwaukee Sewage-Disposal Extension—Extensions to the plant of the Milwaukee Sewerage Commission costing $1,109,000 were completed or under construction at the end of the year. The work was started in 1931 to increase the capacity from the present 85 m.g.d. to 150 m.g.d., since 105 m.g.d. is contributed by the district and 20 m.g.d. of raw sewage is discharged into the rivers. A 28-acre area adjacent to the existing plant was reclaimed from the lake by an outer bulkhead and dock wall at a cost of $685,000. Within this area a cofferdam inclosed a 800x800-ft. site for additional aeration and settling tanks. Plans for the tanks are complete, and work will start when funds are available.

✦

River des Peres Drainage—The last of the contracts for the River des Peres drainage works in St. Louis was completed in 1932, and the project is in service except for two small sections.

✦

Sanitary District of Chicago—In accordance with the Supreme Court decree of April 21, 1930, the Sanitary District of Chicago has accomplished on its sewage-treatment program in new work a total expenditure of $100,544,400, of which $424,730 was expended in 1932. At the end of 1932 the population equivalent under treatment was 2,427,000, or on a 100 per cent basis, 1,578,000.

Practically no construction work was done in 1932 because of the inability to pay contractors. More than $8,810,000 of work is still under contract, principally at the West Side and Calumet Works and on West Side intercepting sewers. Plans are ready for more than $6,000,000 of additional work. Preparation of plans has continued, with greatly reduced forces. Application has been made to the R.F.C. for a loan of $36,450,000.

Delay by lack of finances has not been entirely lost time. Advantage has been taken of the opportunity to explore improvements in the art of sludge disposal and to produce economies in construction as well as operation.

✦

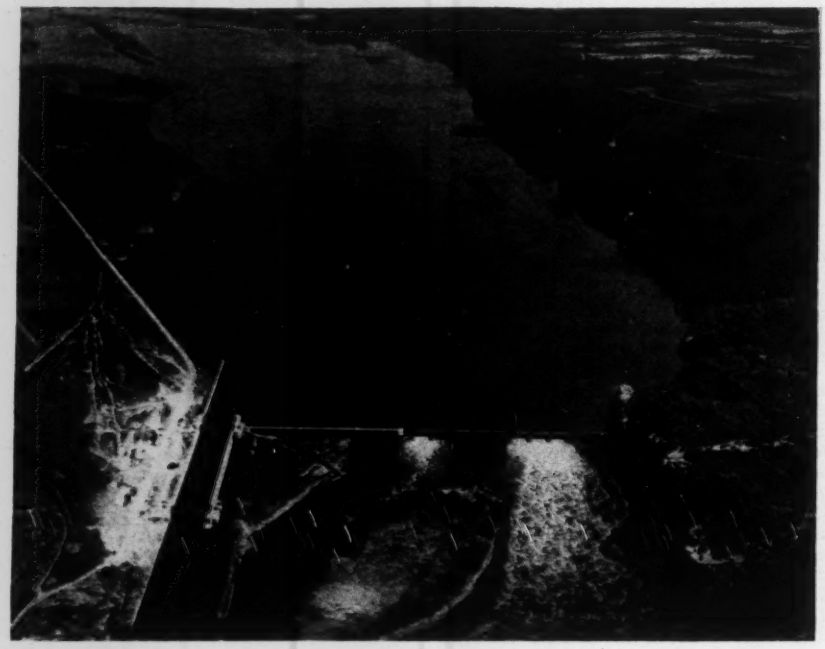
Cleveland Sewage Plant—Construction of the new Easterly activated-sludge plant at Cleveland was about 90 per cent completed at the end of the year. Most of the remaining work is on the operating gallery and is expected to be completed early this year. Equipment is now being installed. The capacity of the plant is to be 123 m.g.d.

✦

Wards Island Sewage-Treatment Works—Rapid progress was made during the past year on the sewage-treatment works being constructed by the Department of Sanitation of the city of New York, on Wards Island. This plant is of the activated-sludge type with a rated capacity of 180 m.g.d. Construction was started on June 18, 1931. A contract for the dock and seawall was completed by the end of 1932, and that for the tanks and operating galleries is essentially completed, this latter work being greatly in advance of the time limit allowed. Plans for the remaining contracts on the treatment works are finished, and those for the intercepting sewers will be ready in the course of the year. The entire project is expected to cost about $24,000,000.

Completed lock and dam at Starved Rock on the Illinois waterway. Pool regulation is by ten tainter gates 60 ft. wide and 20 ft. deep.

Chicago Aerial Survey Co.



Bridge Construction

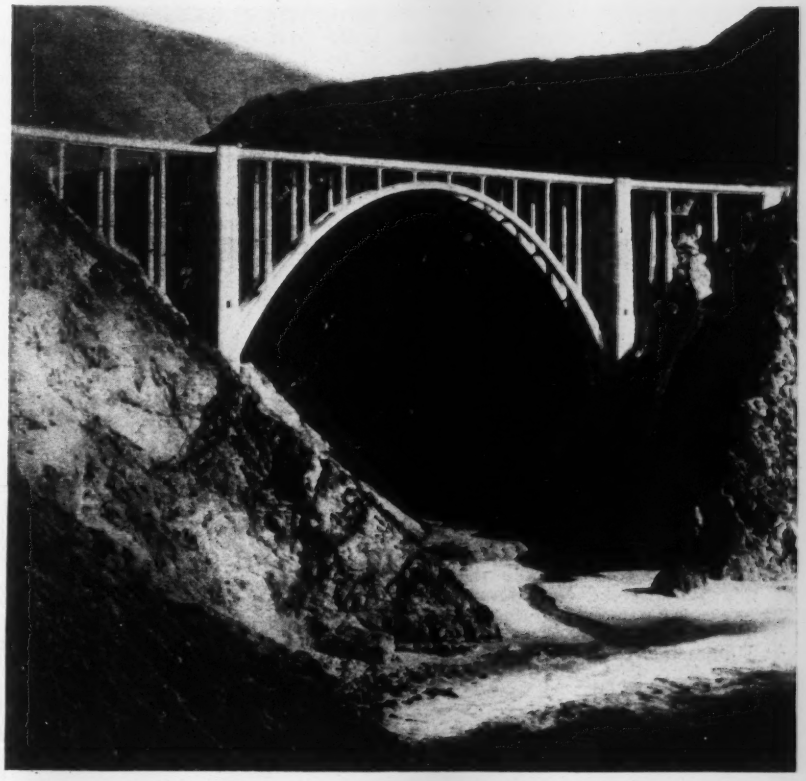
Golden Gate Bridge—Active construction on the Golden Gate Bridge from San Francisco to Marin County started Jan. 5, 1933, with excavation at the North anchorage site. During 1932, when both state and federal courts upheld the formation of the Golden Gate Bridge and Highway District and its right to taxation, an application of the district for an R.F.C. loan was withdrawn when open-market financing appeared possible. Subsequently, a block of several million dollars of bonds was sold to a local bank, but the terms of the transaction resulted in an interest rate slightly in excess of the 5 per cent limit, and the legality of the sale is now before the State Supreme Court. The matter of financing will not delay the construction program. During the months of legal controversy the original construction contract expired, and new bids were called during 1932, resulting in slightly reduced costs. A new group of contracts was awarded, with the exception of the $10,000,000 contract for the steel superstructure, which was extended. The bridge with its 4,200-ft. suspension span is to be a publicly owned and operated toll bridge. The district, comprising San Francisco and several counties north of the Golden Gate, voted a $35,000,000 bond issue for the project by a three-to-one majority in 1930.

✦

San Francisco-Oakland Bridge—Start on the $75,000,000 San Francisco-Oakland Bridge across San Francisco Bay is awaiting action of the California State Legislature in agreeing to the various stipulations imposed by the R.F.C. in connection with its $62,000,000 loan for this project. The west-channel crossing between San Francisco and Yerba Buena Island will consist of two 2,300-ft. suspension spans with 1,150-ft. side spans and a common gravity anchorage in midchannel. The island will be pierced by a double-deck tunnel 500 ft. long, and the bridge will continue with a 1,400-ft. cantilever span over the main east channel, followed by a series of shorter spans to the long approach fill extending to the Oakland side. The structure will provide an upper deck for six lanes of rapid vehicular traffic and a lower deck for two rapid-transit lines and heavy trucking. The structure will be a publicly owned toll bridge built under the direction of the California State Toll Bridge Authority and financed by revenue bonds. Bids for the main piers in the west channel have already been called, and the contract will be let as soon as the necessary action of the legislature has been taken. Plans and specifications for additional units of structure are ready for bidding. The present program calls for completion in 1937.

✦

Chicago Outer Drive—The North approach and the substructure of the Michigan Canal bridge, an important element of the Outer Drive at Chicago, were completed late in 1931, as was the substructure of the viaduct between the Michigan Canal bridge and the Chicago River Bridge. Bids for the superstructure were called but were rejected.



Bixby Creek bridge on the coast highway between San Francisco and Los Angeles, a 320-ft. concrete arch, the largest in the West.

Contracts for both the substructure and superstructure of the Outer Drive bridge were let in 1931, and work upon it was about 45 per cent complete when all work was shut down early in 1932 because of financial conditions.

✦

Henderson Bridge — The new Ohio River crossing of the Louisville & Nashville R.R. at Henderson, Ky., was completed during the year. The channel span is 675 ft. long, and there are four 500-ft. spans and one 240-ft. span in addition to a long girder approach on the Indiana side of the river. Single-track operation is to be used, although the main span and the foundations for the approaches have been built to accommodate double track.

City Hall and Court House, St. Paul, Minn., dedicated on Dec. 19, a 20-story building forming part of a riverfront development.

✦

Belt Bridge, New Orleans—New contracts for this combination railway and highway bridge over the Mississippi River were signed on Dec. 30 after the R.F.C. had advanced the state highway department about $7,000,000 and the Public Belt Railroad about $6,000,000 to cover their respective shares of the cost. The original contracts let in 1931 were permitted to lapse when financing by the state through regular banker channels became impossible. The main bridge will be a cantilever structure with a 790-ft. main span and 530-ft. anchor spans. Channel clearance will be 135 ft. at the center. Long approaches are required. Foundation construction will be the most difficult task, as piers must be sunk more than 150 ft. below low water.

✦

Bridges at Cleveland—The Lorain-Carnegie Bridge, a long steel viaduct over the Cuyahoga Valley, was the outstanding structure opened to service in 1932 in Cleveland. A traffic circle is planned at the east approach, which is just south of the Union railroad terminal, but the county commissioners were enjoined at the end of the year from spending $650,000 for the necessary property. Although designs have been made for a steel arch bridge at

Main St., taxpayers' suits have held up any further progress. Cuyahoga County completed the Beckville-Northfield Bridge and the Bedford Bridge, the former of five 181-ft. concrete arches and the latter of seven 160-ft. concrete arches. Brookpark Viaduct, consisting of eight 192-ft. span concrete arches, is under construction.

✦

Triborough Bridge, New York—Foundations for the Triborough Bridge at New York were completed during the year, but no action has been taken by the city toward letting the superstructure contract. The bridge will connect the boroughs of the Bronx and Manhattan with the borough of Queens on Long Island, crossing the East River at Hell Gate with a 1,380-ft. suspended span.

✦

New Jersey High-Level Viaduct—The high-level viaduct extending for some 3 miles over the Newark Meadows in New Jersey and including two 550-ft.-span cantilever river crossings was completed and opened to traffic late in the year. It was built by the New Jersey state highway department to relieve congestion on the roads approaching the Holland tunnel to New York.

✦

St. Lawrence River Bridge — Contracts for the construction of a highway bridge over the St. Lawrence River near Lachine to the west of Montreal were let in November. The structure with its approach fills will have a total length of 4,500 ft. The bridge proper will be of steel trusses on concrete piers. The total cost will be about $2,600,000. The bridge is to be a toll structure publicly owned.

✦

Bridges at Pittsburgh — The year brought to an end a notable period of bridge building in Pittsburgh and Allegheny County. The five-span George Westinghouse Bridge, whose main span of 460 ft., c. to c. of piers, is the longest concrete arch in America, was opened to traffic, saving 20 min. of time for Lincoln highway travelers. The 780-ft.-span tied arch over the Ohio River, known as the West End Bridge, was completed, affording a connection between Pittsburgh's street system and the Saw Mill River Boulevard. The 4-in.-diameter wire rope hangers on this bridge are the largest ever fabricated. The Boston Bridge over the Youghiogheny River, a cantilever structure with a 420-ft. main span, unique in that overhead bracing is confined to three panel points at either end, was opened. The new South Tenth St. 725-ft.-span suspension bridge over the Monongahela River is practically complete. Of the parallel-wire cable type, the bridge is unique in that requisite stiffening is secured by girders that extend only about 3 ft. above the sidewalk level. The deck is designed for double street-car tracks. Both this structure and the Boston Bridge utilize a concrete-filled steel-grid type of floor.

Land Reclamation and Flood Control

Hoover Dam — Progress on Hoover Dam in Black Canyon of the Colorado River was reported in detail in our issue of Dec. 15.

✦

All-American Canal — Negotiations looking toward the execution of a contract for the construction of the All-American Canal to serve lands in the Imperial Valley in California, as provided for in the Boulder Dam Act, resulted in the confirmation of a revised contract by the Imperial Irrigation District in February, 1932. This contract was amended in December to permit the inclusion of lands in the Coachella Valley, and on Jan. 12 of this year the Imperial District, by a seven-to-one vote, approved it. Under this contract the Coachella Valley must petition to be included within 30 days after Jan. 12, 1933. The Imperial District is now ready to petition Congress for an appropriation for construction. The canal is estimated to cost $35,000,000.

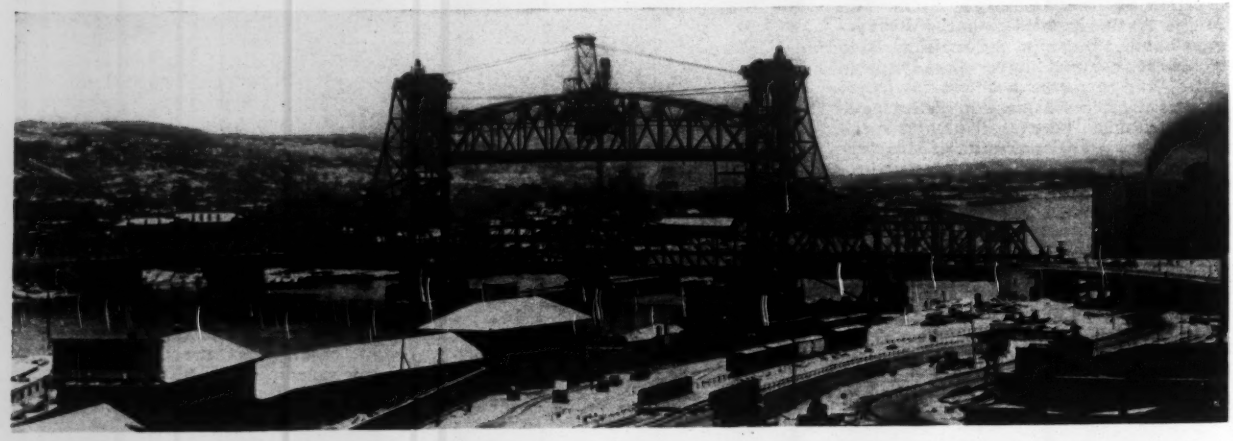
✦

Owyhee Project—The 530-ft. Owyhee Dam built by the Bureau of Reclamation for irrigation development in eastern Oregon was completed in 1932. The 3½-mile tunnel (No. 1) from the reservoir to the distribution system also was finished. Storage in the 715,000-acre-ft. reservoir was begun in the fall. It will be used to provide a supplemental water supply to lands already under irrigation and, in addition, to provide for some new area. The inlet end of the 4¼-mile tunnel (No. 5) was completed eighteen months ahead of schedule, and the outlet end, which encountered heavy ground that required a mile of steel lining, in addition to the concrete, is now being lined ahead of schedule. Work on the first 5 miles of the North canal on the distribution system, which includes earth canal, lined canal, flume, short tunnels, siphons and other structures, is partly contracted and under construction. Two short tunnels on this canal line have been completed, and most of the excavation is finished. The 1933 construction program includes the completion of the North canal to Mitchell Butte and the building of a lateral to connect with the Ontario-Nyssa Canal. About 60 per cent of the entire project has been completed.

✦

Cle Elum Dam—To provide 350,000 acre-ft. of supplemental storage for the Yakima Project in central Washington, the Bureau of Reclamation is building the Cle Elum Dam, a rolled-earth embankment 135 ft. high above streambed. The addition of spillway gates can later increase the capacity of the reservoir by 70,000 acre-ft. About 1,250,000 cu.yd. of rolled fill is required. For diversion and permanent outlet a 14-ft.-diameter tunnel 1,700 ft. long was driven and lined with concrete under the south abutment. Most of the fill was placed during the last season, and it will be completed during 1933, with final completion of the

A new bridge over the Hudson River from Albany to Rensselaer is being built by the New York state highway department to replace the present inadequate structure. The new bridge has a 42-ft. roadway, a 6½-in. reinforced-concrete slab, with a 2½-in. asphalt wearing surface, and two 6-ft. sidewalks. The 341-ft. lift span is the heaviest yet built, the moving load being 12,000,000 lb. The clearances are 35 ft. closed and 135 ft. with the movable span open. The cost of the bridge is $2,500,000.



project scheduled for March, 1934. The project represents a cost of about $2,750,000.

✦

Eagle Pass, Tex., Irrigation and Power—The power plant and 32 miles of the main irrigation canal and 25 miles of branch canal of the Maverick County Water Improvement District No. 1 power and irrigation scheme were completed during the year. The entire project includes 90 miles of canal, with provision for irrigation by gravity of 15,000 acres from the present main canal and 60,000 acres from the 90-mile canal system, with 25,000 acres additional if pumping is employed. In November the R.F.C. granted the district a loan of $1,476,000 for continuation of its work and for repair of $150,000 damage done by a severe flood. The loan will be used to construct the remainder of the main canal, about 60 miles, and to install the main laterals for delivery of water to the remaining 45,000 acres of the district. The extension will contain a wood-stave siphon 10.5 ft. in diameter and 1 mile long.

✦

Rodriguez Dam, Mexico — Contracts for the construction of Rodriguez Dam, the highest buttress-type dam yet undertaken, were let in February, 1929, but active work was suspended in the fall of 1930 and was not resumed until late in 1931. The dam is to form a storage reservoir of 110,000 acre-ft. capacity in the Tijuana River near Tijuana, Mexico, 27 miles southeast of San Diego, Calif. It will be 240 ft. high above the lowest foundation rock. Work in the dam is about 45 per cent complete.

✦

San Gabriel Flood Control—Active construction operations on the revised program of flood control and conservation characterized the progress of the San Gabriel River project during 1932. Following completion of the extensive studies made by the Los Angeles County Flood Control District after the abandonment of the Forks site several years ago, work was started on the revised schedule of two dams to provide 85,000 acre-ft. of regulatory storage. Contract for San Gabriel Dam No. 2, on the west fork, was let, and construction is well advanced on this 255-ft. rockfill dam. The dam will contain about 1,000,000 cu.yd. of rock and will cost $3,000,000. Following two rejections of bids for the San Gabriel No. 1 dam, contract was awarded on the basis of the third set of bids for this 360-ft. rockfill dam containing 5,000,000 cu.yd. of material.

✦

Middle Rio Grande Flood Control—160 miles of levees, one diversion dam, 160 miles drainage ditches and 60 miles of interior drains, involving the moving of 12,000,000 cu.yd. of earth, have been completed by the Middle Rio Grande Conservancy District. This work, including the purchase of major equipment sufficient to complete the job, has cost approximately $3,000,000. The construction of riverside drains is now approximately 90 per cent complete, and work for the future will consist of constructing 513 miles of irrigation main canals, a storage dam of 198,000-acre-ft. capacity and four river headings that will cost approximately $240,000. The Conservancy District, in October, 1932, received a loan from the R.F.C. totaling $5,784,000 for the construction of the above work.

✦

Mississippi Flood Control — Progress in 1932 on the flood-control works of the new project authorized May 15, 1928, has far exceeded that of any previous year. The outstanding work has been levee construction, in which well over a hundred million yards were placed, below Cape Girardeau, during the twelve months. Interrupted by high water until about June, the construction forces swung into action in July with 14,267,000 yd.; August, 16,517,000; September, 17,409,000; October, 14,229,000; and November, 11,267,000. With 7,455,000 yd. for December, the total for the last half-year of 1932 was 82,777,700 cu.yd. This figure exceeds or closely approaches any previous twelve months' work. Incidentally, the largest volume handled in any one year in constructing the Panama Canal was 32,000,000 cu.yd. Bank revetment and channel regulation by wing dikes have gone ahead at normal pace.

✦

Bonnet Carré Spillway—Located 33 miles above New Orleans, the Bonnet Carré spillway is designed to divert 250,000 sec.-ft. from the Mississippi River to Lake Pontchartrain after flood crests reach El. 20 on the Carrollton gage at New Orleans. The 7,698-ft. spillway weir was completed in 1931, and work on the 12 miles of levees along the sides of the 5.7-mile channel is now well along toward completion. In August an appraisal commission awarded the state highway commission $741,000 for an 8,000-ft. causeway over the channel. Litigation over the railroad crossings is still in the courts. Total cost of the project to date is over $8,000,000.

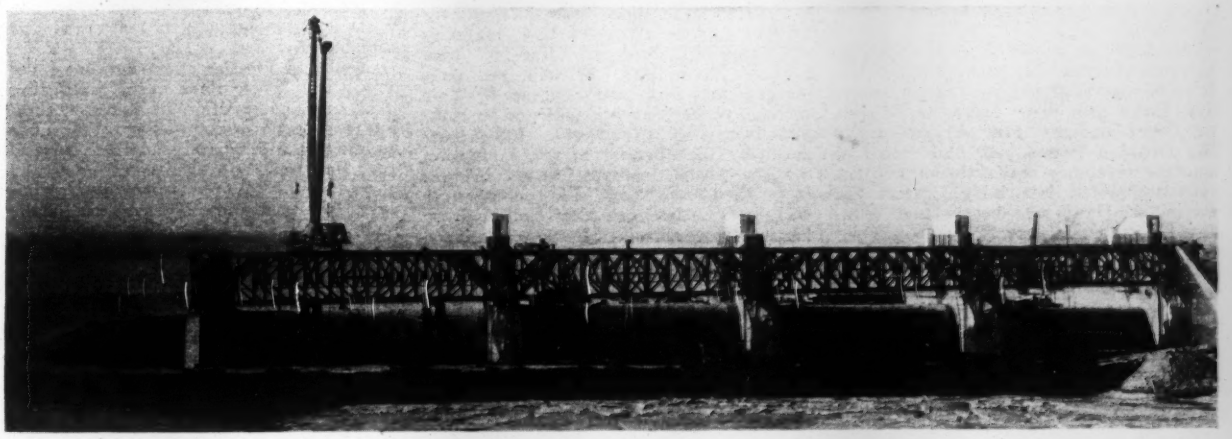
Inland Waterways

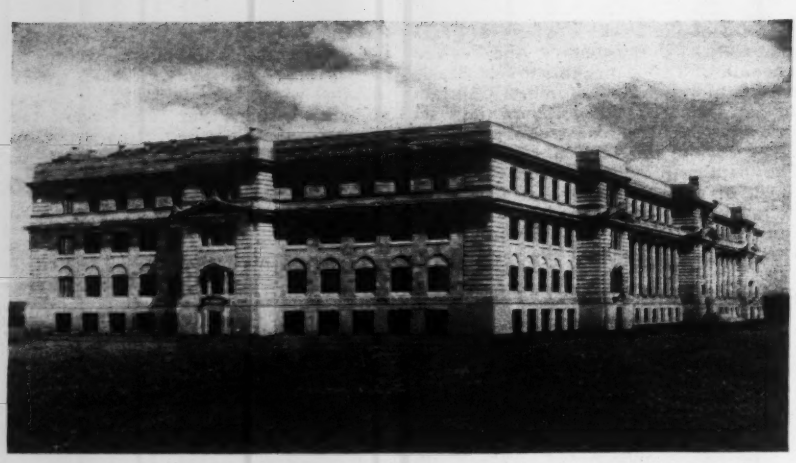
Stockton Channel — Improvement of the lower 44 miles of the San Joaquin River, Calif., providing a 26-ft. depth of water from San Francisco Bay to the city of Stockton, has been completed. The river development was carried on as a joint project by the city and federal government and represented a cost of about $6,000,000. A channel 26 ft. deep at low water with a 100-ft. bottom width has been dredged in the river channel to within about 17 miles of Stockton, and from this point a new artificial channel was excavated to a turning basin where the city is building terminal facilities. About 16,000,000 cu.yd. of hydraulic dredging was included in the project.

✦

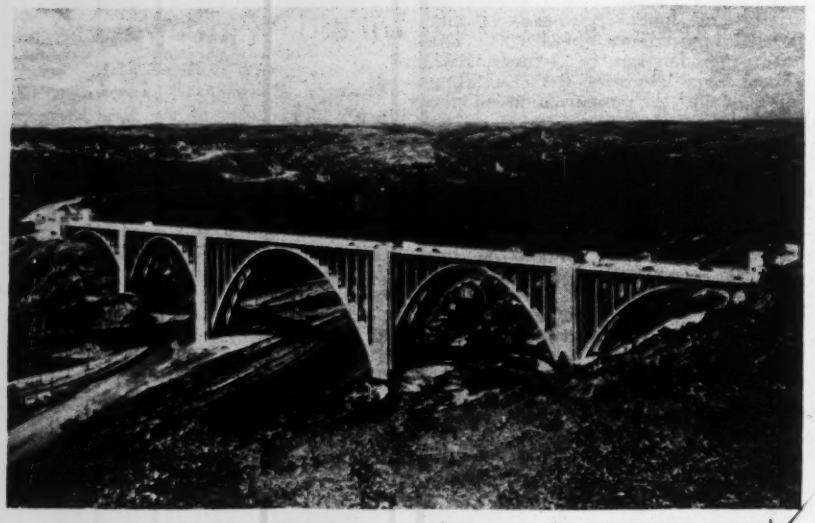
Illinois Waterway — The Illinois Waterway, the final link in the Lakes-to-Gulf channel, extends from the lower end of the Chicago Drainage Canal at Lockport to Starved Rock, a distance of 60 miles. Channels are to be 200 ft. wide and 9 ft. deep. Construction was begun by the state of Illinois and was later taken

Dam No. 15 on the Mississippi River at Rock Island, Ill. Four of the eleven 220-ton roller gates 109 ft. long are shown here. Two gates are to have a depth of 24 ft., and nine are to be 26 ft. deep. The open clearance will be 33 ft. A 30-ton crane to handle drift will operate over the service bridge. Two locks, 110 ft. long and 600 and 360 ft. long, respectively, are included in the project, which is a part of a larger project to provide a 9-ft. navigation channel from St. Louis to St. Paul.





National Research Laboratory, Ottawa, Ontario, for the National Research Council of Canada. The building, erected by the Canadian government at a cost of $3,000,000, is a series of laboratory units with accommodation on the main floor for the council staff and a 300,000-volume research library. Engineering laboratories at the back extend through the basement and first floor to provide for testing machines.



George Westinghouse Bridge on the Lincoln Highway near Pittsburgh, Pa. The Central Span, 460 ft. center to center of piers, is the longest concrete arch in America.

over by the federal government after the state had expended $20,000,000. The expenditures by the United States will be $7,500,000.

The lock chambers are 110x600 ft. All dams are of the gravity type, the pools being regulated by tainter gates. Five locks and four dams have been completed and are now in operation. The Dresden Island lock and dam and concrete retaining walls through Joliet were completed late in 1932, and the Marseilles Dam was begun and completed during the year.

All contracts for this dredging were let early in 1932, and by the end of the year a usable channel was available. The work of widening to 200 ft. and deepening to 9 ft. is being pushed, and by the opening of the navigation season in the spring, commercial traffic will be able to proceed from the Mississippi River to Chicago. Due to ice conditions in the Illinois River no navigation is possible during the winter months.

Orders have been issued requiring owners to revise obstructive highway and railroad bridges. Twelve new bridges have been, or will be, constructed and four bridges altered. This work is proceeding but will not be completed in time to provide full clearances by the opening of the navigation season. Until the work on the bridges is finished, the controlling clearances will be 133 ft. horizontal and 19.2 ft. vertical from Starved Rock to Joliet.

✦

Missouri River Improvement—During the past year 59 contracts involving $11,353,055 were awarded on the two Missouri River projects, which are providing from Sioux City to the mouth a 6-ft. channel 200 ft. wide by means of open-river improvements such as bank revetment, permeable dikes and occasional dredging. Thirty-two contracts were carried over from 1931, and 43 were completed during the year. All work now under contract is well under way and should be completed by September. A total of 313,223 lin.ft. of dikes and 101,614 lin.ft. of revetment were constructed during the last year. Two new 34-in. pipe-line dredges of the "dustpan" type, put to work in May and June, have dredged 14,400,000 cu.yd. at a cost of 3.1c. per yard. Upon completion of existing contracts the stabilization of the river from Kansas City to the mouth will be 98 per cent complete. From St. Joseph to Kansas City it will be 76 per cent complete.

Railways and Rail Terminals

Cincinnati Union Terminal—The new terminal, which will be used by all railroads entering the city, is expected to be opened to operation in April of this year. The main terminal building is about completed. The Southern R.R. freight yard, the C.&O. R.R. Chicago connection and the 3,500-ft. double-deck Western Hills viaduct have been placed in operation. Work is progressing to completion on the southeast connection, which leads to the C. & O. bridge across the Ohio. Lack of funds has prevented completion of the permanent structures on the southwest connection, which will be used by the B. & O. and Big Four railroads to the West. Temporary structures of pile and timber construction are being built to put this line into service. Start of construction of the Sixth St. viaduct, to be built by the city, has been delayed by financial troubles.

✦

Philadelphia Passenger Terminals — Construction of the new passenger terminals of the Pennsylvania R.R. in Philadelphia was continued during the year 1932. The new station building at 30th St., west of the Schuylkill, is nearing completion, and considerable work has been done in connection with the approach trackage and car yards. Work on the new facilites is sufficiently advanced to permit the operation of the New York-Washington service through the new station in the early part of the year 1933, at which time the old station at 32nd and Market Sts., known as the West Philadelphia Station, will be abandoned.

Contracts for the construction of the new U. S. post office were let during 1932, and the erection of the structural frame is progressing. The post office building is immediately adjacent to and over the south approach trackage to the new station. The plans provide for conveyor systems and platforms to handle mail between the post office and trains.

✦

Pennsylvania Electrification — The electrification program of the Pennsylvania R.R. has progressed to the point where operation of electric locomotives in the regular passenger service between Philadelphia and New York was inaugurated in January, 1933. By March the passenger service from New York

to Washington will be electrically operated as far as Wilmington, Del. Trains between New York and the West, which stop at North Philadelphia, will be operated electrically as far as Paoli, Pa. Suburban services are in operation from Philadelphia to Trenton and from New Brunswick to Jersey City.

✦

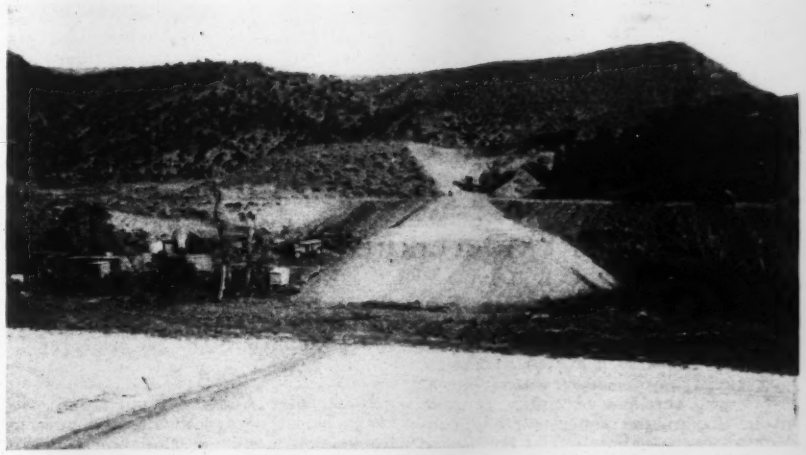
Reading Electrification — Electrification of the Chestnut Hill line of the Reading R.R. at Philadelphia is practically completed. Test runs were begun about the middle of January, and the service was inaugurated in February, 1933. A passenger station at Norristown has been completed and placed in operation.

✦

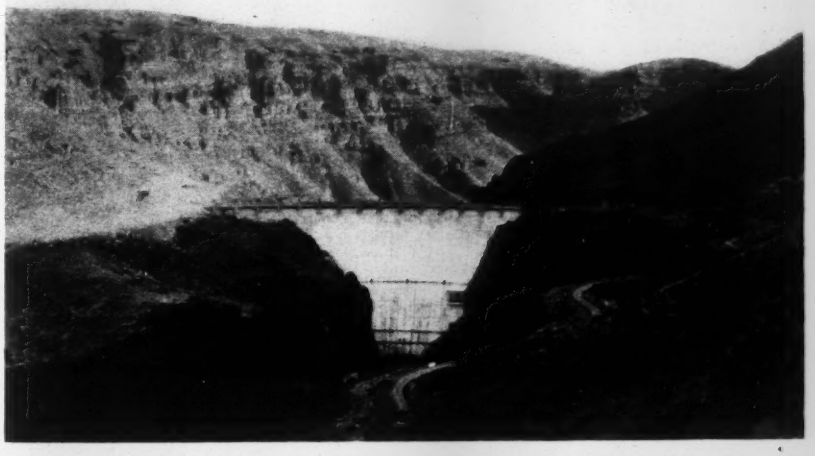
Inland Freight Terminal, New York —The union off-rail terminal, which the Port of New York Authority built for the use of the eight railroads serving New York City was put into service in October. The terminal occupies the ground floor and basement of the Port Authority's Commerce Building, a structure that is now nearing completion. The cost of structure, exclusive of site, was $8,750,000.

✦

Canadian National Terminal, Montreal —Reconstruction in Montreal of the passenger and freight terminals of the Canadian National Railways System, begun in October, 1930, was largely discontinued in October, 1931, because of financial conditions.



Construction camp on the Dotsero cutoff at the site of the Colorado River crossing at mile 25. Trucks now cross the river on the ice. Contracts for this new railway line connecting the "Moffat Road" west of the Moffat tunnel with the Denver & Rio Grande Western were let by the D. & R. G. W. in October and work at key points, including river crossings and one long tunnel was begun in November.



Owyhee Dam, Owyhee irrigation project in eastern Oregon. The dam is of the arched-gravity type, 530 ft. high above the lowest foundation and 325 ft. above river level.

Municipal Rapid-Transit

Philadelphia Subways — During the past year several subway-construction contracts were completed or practically completed, under the supervision of the Department of City Transit of Philadelphia. Included in this work is the new Market St. bridge, a concrete arch with the subway carried through its piers and abutments. The bridge is across the Schuylkill River and is part of the improvement program participated in by the city, the B. & O. R.R., and the Pennsylvania R.R. The highway bridge has been opened to traffic, but as yet the subway cannot be put in operation, as there are no terminal facilities at the western terminus. Ultimately this tube will be extended farther westward into West Philadelphia.

The Ridge Ave.-Eighth St. extension of the Broad St. subway, costing $8,000,000, was placed in operation in December. The South Philadelphia extension of the Broad St. subway is now practically completed, except for the necessary station finish work, track-laying and permanent paving of the street. When this work has been completed, the tube will extend from its present terminus at Olney Ave. at the northern end, to Snyder Ave. at the southern end. The work of straightening the Market St. subway express tracks under City Hall, involving the underpinning of City Hall, is still in progress.

During 1932, 21 contracts were under way, involving approximately $8,500,000 worth of work. About half of these contracts are completed. Uncompleted contracts will require the expenditure of approximately $5,000,000 during the coming year, but no new work is contemplated.

✦

Detroit Rapid Transit — Forty per cent of the right-of-way has been acquired for carrying out the regional plan of superhighways and thoroughfares designed by the Detroit Rapid Transit Commission in 1923 and two years later officially adopted by the city and counties. Considerable mileage has been added by dedication in 1932 due to low land values. More than 100 miles of pavement have been laid on the 204-ft. superhighways and 160 miles on the 120-ft. thoroughfares. Vehicle weight-tax funds collected by the state and returned in part (nearly one-half) to the counties on the basis of registration have been used in part, and Detroit contributed $12,000,000 from general taxation in the period 1924-1930 for widening within the city limits.

✦

New York Subways — On Sept. 10, 1932, eight years after start of the work, the first section of the New York independent subway system was placed in operation by the city. This section, 12.3 miles long and containing 46.6 track-miles, extends from Church and Chambers Sts. in lower Manhattan up Eighth Ave. to 207th St. The city placed the line under municipal operation after rejecting three bids for private operation. The entire independent system will be 54.4 miles long, will contain 179 miles of track, and will cost $650,000,000. All structural work on the system has been finished or is under contract, except the Sixth Ave. line in Manhattan. Present plans contemplate extending operation from Chambers St.

through the Fulton St. tunnels to Borough Hall in Brooklyn early in February. Recent appropriations provide for the completion of the line into the Bronx to 205th St., the Queensborough line as far as Roosevelt Ave., Jackson Heights, and the Smith St.-Culver line connection into south Brooklyn by mid-summer. Construction contracts are still under way on the Houston-Essex line in Manhattan, the Fulton St. and cross-town lines in Brooklyn and the extension of the Queens line to 178th St. Since the start of work, July 1, 1924, a total of 620 contracts, aggregating $506,369,621, has been let by the Board of Transportation for the new system.

Miscellaneous Undertakings

West Side Elevated Highway, New York—During the year foundations for a third section (from 38th to 48th Sts.) of the West Side Elevated Highway, along the Hudson River waterfront at New York, were placed under contract, and letting of the superstructure contracts awaits authorization of the Board of Estimate. The second section, from 22nd to 38th Sts., was opened to traffic early in 1933, the first section from Canal St. to 22nd St. having been in use since Nov. 13, 1930. The fifth section, from 59th to 72nd Sts., has been in use since March 9, 1932. Plans are in progress on the fourth section, from 48th to 59th Sts., but no construction can go ahead until completion of the new 1,100-ft. ocean-liner piers in that neighborhood. Extension of the highway above 72nd St. will be carried out by the New York Central R.R.

✦

Boston Transit Tunnel—The two-lane vehicular tunnel, 6,000 ft. long, connecting Boston and East Boston, is nearing completion and will probably be opened to service this year. Driving of the tunnel itself has been completed. Work remains to be done at the entrances and approach plazas.

✦

38th St. Vehicle Tunnel, New York—During the latter part of the year the Port of New York Authority made application to the R.F.C. for a loan to start construction of a second vehicle tunnel under the Hudson River at New York, but action by the R.F.C. was postponed at the request of city officials. The projected tunnel would be in the neighborhood of 38th St., Manhattan. Plans have been prepared and options obtained on land, following authorization of construction by the state legislature in March, 1933.

✦

Rockefeller Center — Substantial advance was recorded during the year at Rockefeller Center in New York. Previously known as Metropolitan Square and Radio City, this three-block building development now includes a completed 31-story office building, two completed theaters, a 69-story office building nearing completion and a six-story office building under construction. In general, the 6th Ave. frontage, which comprises Radio City, is complete. The six-story building is the only structure on Fifth Ave., although a similar building is planned for early construction. All of the old buildings on the three-block site have been demolished. The new north-south street through the center of the development is under construction.

✦

A Century of Progress—Status of the World's Fair in Chicago as it entered 1933 is as follows: construction program two months ahead of schedule; every primary and secondary building either completed or under construction; every minor structure provided for. An underground network of conduits and sewers, 95 to 100 per cent complete, includes 10 miles of water mains, 10 miles of sanitary sewers, 5 miles of storm sewers, 10 miles of conduits and utility cables. Pumping stations for both water and sewage are well under way.

As to the financial and commercial aspects, the fair has cash and government securities of $1,400,000 on hand, and its bonds are selling at par. The gross area of space in exhibits buildings was 82 per cent sold.

✦

Federal Buildings — The extensive federal government program of post-offices, office buildings and court houses throughout the country and departmental structures in Washington, D. C., was carried on at an accelerated pace during the past year. The following table gives pertinent data relative to all jobs costing $2,000,000 or over.

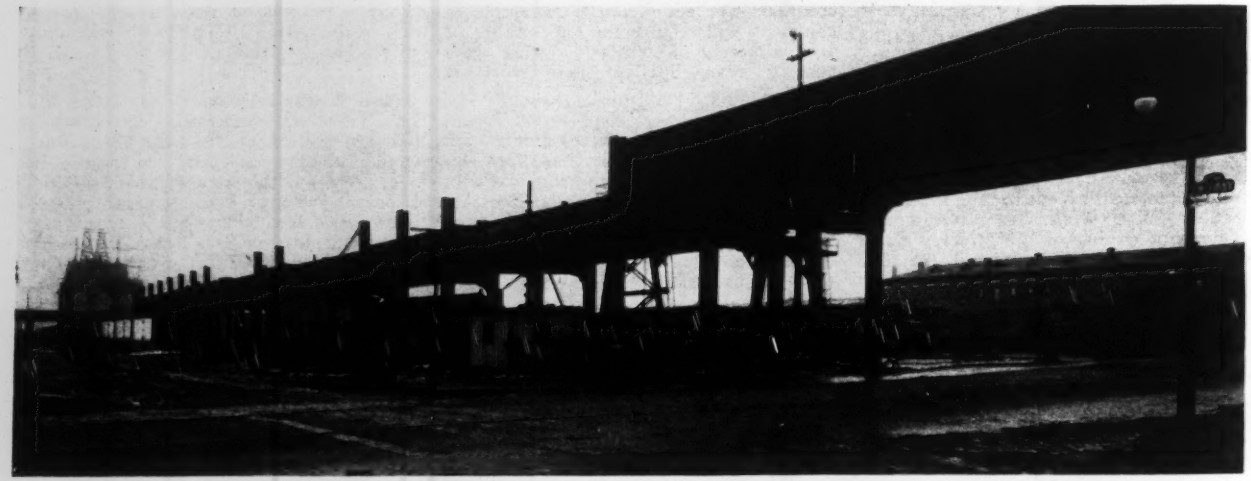
LARGE FEDERAL BUILDINGS

Location and Type of Building	Cost	Per Cent Complete	Date of Occupancy
Albany, P.O., Ct. & Cu.[1]	$3,325,000	1	3/1934
Atlanta, P. O.	2,975,000	45	12/1933
Baltimore, P. O.	3,300,000	100	.....
Boston, P. O. & Ct.	6,000,000	80	8/1933
Chicago, P. O.	26,475,000	76	.....
Cincinnati, P. O.	3,000,000	10	.....
Cleveland, P. O.	5,275,000	*	1/1/1935
Detroit, P. O., Ct. & Cu.	5,650,000	40	9/1933
Hartford, P. O. & Ct.	2,000,000	94	3/1933
Jacksonville, C. H.	2,000,000	*	5/1934
Kansas City, Mo., P. O.	4,500,000	82	6/1933
Louisville, P. O., Ct. & Cu.	2,985,000	100	.....
Miami, P. O., Ct. & Cu.	2,080,000	67	5/1933
Minneapolis, P. O.	3,790,000	3	7/1934
New York, Assay office	3,765,000	100	.....
Court house	10,700,000	Fnd-13	.....
P. P. bldg.	11,000,000	76	7/1933
P. O. annex	9,500,000	43	4/1933
Philadelphia, Ct.	3,880,000	...	.....
P. O.	9,750,000	1	9/1934
Pittsburgh, Ct. & P. O.	8,852,000	38	3/1934
Portland, Ore., Ct.	1,950,000	64	5/1933
St. Louis, Ct.	3,550,000	78	3/1933
St. Paul, P. O. & Cu.	2,700,000	100	.....
San Francisco, Office bldg.	3,050,000	*	.....
Newark, P. O.	6,150,000	6	6/1934
Seattle, Office bldg.	2,375,000	90	3/1933
Washington, D. C.:			
Agriculture	12,800,000	10	6/1934
Archives bldg.	8,750,000	*	1/1935
Heating plant	5,749,000	*	1/1934
Labor	2,000,000	22	2/1934
I. C. C.	4,500,000	22	2/1934
P. O. Dept.	10,300,000	19	7/1934
Justice	12,000,000	17	7/1934

*Started.

[1]P. O. — post office; Ct. — court house; Cu. — custom house; P.P. — parcel post.

West Side track elevation work, New York City. This view shows the elevated structure to carry the main tracks of the New York Central-West Side line along the south side of the 30th St. yard west of 11th Ave. The 30th St. yard will be at two levels. This work is part of a $138,000,000 project to remove the railroad tracks from the surface of five miles of city streets. Bids for part of the new terminal at the south end of the line have been called.



Six Months of the Relief Act

Organization difficulties within the Reconstruction Finance Corporation made the Emergency Relief and Construction Act of 1932 largely ineffective until late fall—Forty-nine self-liquidating loans totaling $145,660,000 approved at end of year

AN UNPRECEDENTED event in history occurred in 1932, the extension of federal aid to general construction by states, municipalities and even to private corporations. This aid was made possible by the passage on July 21 of the Emergency Relief and Construction Act of 1932, an act that crystallized six months of intensive effort aimed at getting the government to provide funds to check the rapid decline of public construction that began in 1931 as the best way to stop the spread of unemployment. The act also was the culmination of other efforts extending over a longer period which had as their object the issue of from two to five billion dollars worth of federal bonds to finance an enormous program of public construction as a means of business revival. As passed, the act was frankly a compromise. Partly as the result of the compromises made to insure its passage but also as the result of a lack of enthusiasm for the measure on the part of those charged with administering it, the act has fallen far short of accomplishing that which was expected of it, except for the financing of a direct dole. Its construction-aid provisions have been substantial failures.

Provisions of the relief act

Briefly, the act provided 300 millions for charity loans to the states, 1,500 millions for loans to states, municipalities and private parties to promote local public works and housing, these two to be administered by the Reconstruction Finance Corporation, and 322 millions of Treasury funds for federal construction, including public buildings, highways, roads, flood control and river and harbor work. Its outstanding feature is the self-liquidating limitation put upon loans to states, municipalities and corporations for the construction of public works. For the purposes of the act a project is deemed to be self-liquidating "if such project will be made self-supporting and financially solvent and if the construction cost thereof will be returned within a reasonable period by means of tolls, fees, rents, or other charges, or by such other means (other than taxation) as may be prescribed by the statute which provides for the project." This limitation, forced into the act by the administration in Washington, greatly reduced the amount of normal public work that could be undertaken with funds borrowed from the Reconstruction Finance Corporation, eliminating many of the projects of the character that this journal and the American Society of Civil Engineers had advocated as both desirable and economically sound.

Relief loans

The relief act has three major divisions or titles. Title I, called "Relief of Destitution," authorized the Reconstruction Finance Corporation to loan $300,000,000 to states for direct doles or for relief work. Its chief interest for the construction industry lies in the provision that such loans must be repaid, beginning in the fiscal year 1935, by five annual deductions from regular federal-aid highway allotments. Thus, unless otherwise provided for by the states borrowing the money, one-fifth of the amounts now borrowed will be eliminated each year from 1935 to 1940 from funds that otherwise would be available for highway use. Up to the end of 1932, the R. F. C. had approved loans of this character totaling $103,700,000. In some states much of this money is being used on roads; thus it is not all lost to useful construction.

Self-liquidating loans

Title II of the act is the most significant from the view of the civil engineer and general contractor. It authorizes the making of loans for self-liquidating projects under four general headings: (1) loans to states, municipalities, and political subdivisions of states, public agencies of states or municipalities and public corporations to aid in financing projects authorized by federal, state or municipal law; (2) loans to limited-

SELF-LIQUIDATING LOANS APPROVED BY THE R.F.C. IN 1932

Metropolitan Water District of Southern California, Colorado River aqueduct	$40,000,000
State of Louisiana and city of New Orleans, combined highway and railroad bridge at New Orleans	13,000,000
Madison, S. D., light plant additions	105,000
Prescott, Ariz., waterworks additions, construction of two dams	50,000
Ogden, Utah, waterworks additions and improvements	645,000
Middle Rio Grande Conservancy District, Albuquerque, N. M., flood control and irrigation	5,784,000
California Toll Bridge Authority, San Francisco-Oakland Bridge across San Francisco Bay	61,400,000
Sandusky, Ohio, waterworks extensions	77,000
Wilmette, Ill., water-pumping and purification plant	580,000
Roanoke Rapids Sanitary District, Roanoke Rapids, N. C., waterworks and sewage system	365,000
Seattle, Wash., waterworks additions, improvements and repairs	1,491,000
Savanna-Sabula Bridge Co., Savanna, Ill., completion of toll bridge across Mississippi	190,000
Columbia, Ky., completion of water system	29,000
Maysville Water Co., Maysville, Ky., water-filtration plant	47,000
Conneaut, Ohio, filtration plant and pumping station	200,000
Gulfport, Miss., cotton compress and storage warehouses	150,000
Covington, Ky., waterworks improvements	75,000
Hillside Housing Corp., New York City, housing project in Bronx	3,957,000
Wanakah Water Co., Hamburg, N. Y., waterworks extension	70,000
Madison Heights Sanitary District, Amherst County, Va., water system	62,500
Bowling Green, Ky., sewer system	616,000
Hobart, Okla., extension of water system	250,000
Maverick County Water Control District, Eagle Pass, Tex., power and irrigation	1,476,000
New York State Bridge Authority, toll bridge across Hudson at Catskill, N. Y.	3,400,000
Sanford, N. C., waterworks additions	45,000
Twin Lakes Reservoir and Canal Co., Olney Springs, Colo., increasing reservoir storage capacity	1,125,000
Tarrant County Water Control and Improvement District, Fort Worth, Tex., flood protection and water storage	450,000
West Monroe, La., waterworks additions	45,000
Denville Township, Morris County, N. J., waterworks enlargement	80,000
Tampa-Clearwater Bridge Co., Tampa, Fla., toll bridge and causeway	600,000
Drainage District No. 7, Marked Tree, Ark., flood-control work	250,000
Kenton County Water District No. 1, Covington, Ky., waterworks additions	35,000
Richmond Bridge Corp., Richmond, Va., bridge construction	1,700,000
Columbia, Ill., waterworks extension	52,500
Valdese, N. C., sewer system	78,000
Hopkinsville, Ky., sewer extensions	305,000
Blackstone, Va., waterworks extensions	10,000
Tyler, Tex., additions to sewage-disposal plant	100,000
Winston-Salem, N. C., sewer-system extensions	180,000
Tybee Waterworks, Savannah Beach, Ga., water-system additions	22,000
Arkansas State Agricultural and Mechanical College, Jonesboro, Ark., two dormitories	185,000
San Diego, Calif., waterworks additions	2,350,000
Friedman Brothers Holding Co., St. Paul, Minn., public market	450,000
City of Chicago, Ill., water-pumping station	2,327,000
Newark Farm Produce Market, Inc., Newark, N. J., public market	55,500
Dallas Farmers Public Market Co., Dallas, Tex., public market	187,500
St. Francis Levee District, West Memphis, Ark., rights-of-way for levees	500,000
Saranac Lake, N. Y., waterworks additions	8,000
Corpus Christi, Tex., repair of dam	500,000
Total	$145,660,000

dividend corporations formed wholly for the purpose of providing housing for families of low income; (3) loans to private corporations to aid in construction, replacement or improvement of bridges, tunnels, docks, viaducts, waterworks, canals and markets, devoted to public use; (4) loans to private limited-dividend corporations for the protection and development of forests and other renewable natural resources which are regulated by states.

Engineering advisers named

Early in August the President appointed a board of engineers to aid the directors of the Reconstruction Finance Corporation by passing upon the engineering adequacy of the plans submitted to it for its approval and by determining whether they are self-liquidating. Subsequently, regional engineering advisers were appointed in the several federal reserve districts.

Many loan applications

Applications for loans began to pour in upon the Reconstruction Finance Corporation as soon as the act was passed, and as a consequence the engineering board had a large accumulation of work to deal with even before it could get organized. Further, inaction by the directors of the R. F. C. on the highly important matter of policy determination handicapped municipal and state officials, the state committees of the National Committee for Trade Recovery, and others who were trying to get states and cities to make applications for loans for needed public works. These bodies lacked guidance as to just what information was needed to make applications acceptable to the Reconstruction Finance Corporation.

This condition remained unchanged until Aug. 29 when the corporation issued a circular (R. F. C. Circular 3) specifying the form of loan applications and the subjects to be covered. The circular was very exacting as to detail in which information was to be given and yet it said nothing on two major points, namely, how the directors were going to interpret the law as to what constituted a "self-liquidating project," and what interest rates they would expect borrowers to pay.

Publication of the circular made it plain that most of the applications then in the hands of the R. F. C. would have to be rewritten. Those interested in them, therefore, undertook to revise them and resubmit them only to encounter a new obstacle to speedy action upon their loan applications, a meticulous concern over details on the part of the engineering board.

Interest rates proved to be another stumbling block because the directors of the R.F.C. asked interest rates that were generally higher than the municipalities had to pay for money in the open market in normal times.

A third source of confusion was the directors' interpretation of the phrase "other than by taxation" as excluding all projects supported in whole or in part by special assessment. This automatically ruled out many projects that had been considered eligible for loans.

The net result of these conditions was the postponement of any definite action on self-liquidating loans until Sept. 13, when the R. F. C. authorized a loan of $40,000,000 to the Metropolitan Water District of Southern California for construction of the Colorado River aqueduct. Two weeks later a loan of $13,000,000 for the Public Belt R. R. bridge at New Orleans was approved, and thereafter a few loan applications were perfected and acted upon at frequent intervals. A complete list of applications approved up to the end of the year is given in an accompanying table.

Highway and public works

By far the most productive section of the Relief Act was Title III—Public Works. It provided $322,224,000 for federal public works, including $120,000,000 for loans to states to take up their federal-aid highway allotments, $16,000,000 for forest and national park roads and roads in Indian reservations, $30,000,000 for river and harbor work already authorized, $15,500,000 for flood-control work already authorized, $10,000,000 for Hoover Dam, $100,000,000 for emergency construction of public buildings in Washington, $10,000,000 for authorized work of the Bureau of Yards and Docks, $15,000,000 for the construction of military posts, and $1,250,000 for work of the Coast and Geodetic Survey.

Because much of the building work financed under this section was already planned for, a considerable amount of the money soon was put into circulation by speeding up the program of construction. The money for federal-aid highway work also began to go into circulation quickly. Up to the end of the year the states had taken up $101,710,000 of this money.

The funds provided under this act are to be repaid to the federal government by ten annual deductions from normal federal-aid highway funds beginning in the fiscal year 1938.

Wage and time restrictions

The act provided that all contracts for highway work financed with R.F.C. funds should contain provisions establishing minimum rates of wages, the rates to be predetermined by the state highway departments. Such minimum rates were established by all the states (*ENR*, Nov. 24, 1932, p. 634). The act further provided that the secretaries of Agriculture and of the Interior could make rules for carrying out the provisions of the sections relating to highways with a view to providing the maximum employment of local labor consistent with reasonable economy of construction. Acting under this authority, the Secretary of Agriculture late in July issued through the Bureau of Public Roads a set of instructions outlining what highway operations should be executed by hand and what by machine (*ENR*, Aug. 4, 1932, p. 142).

A third limitation, applying both to public works and the loans for self-liquidating projects, provided that, in so far as practicable, no individual shall be permitted to work more than 30 hours in one week except in executive, administrative and supervisory positions. This limitation has been set upon all work so far approved except the San Jacinto tunnel of the Colorado River aqueduct, where it is not considered practicable.

First loan made

Although many loans were approved by the directors of the R.F.C. during the last three months of the year, no actual loans were made until late in November, when $360,000 was paid to the Middle Rio Grande Conservancy District. In the last few days of the year the corporation made three other loans, so that at the end of the year the following amounts of money actually had been given out:

Middle Rio Grande Conservancy District	$360,000
Public Belt Ry. Bridge, New Orleans	13,000,000
Chicago pumping station	2,327,000
Prescott, Ariz., water supply	50,000
	$15,727,000

In making these loans the corporation purchased $400,000 of 5½ per cent bonds of the Middle Rio Grande Conservancy District at 90, $7,000,000 of state of Louisiana 5 per cent bonds and $6,000,000 city of New Orleans 5 per cent bonds, both at par, $2,327,000 of 5½ per cent waterworks certificates of Chicago at par, and $50,000 of 5 per cent bonds of the city of Prescott at par.

Interest rates modified

Lowering of interest rates was announced by the Reconstruction Finance Corporation on December 24. In reference to loans for self-liquidating projects the announcement said that if a borrower refinances all its loan on such a basis that the cost of the money to the borrower is lower than the cost of the money received from the corporation, the borrower will be permitted to repay the corporation on the same yield basis as that upon which the borrower refinances such loan, provided the return to the corporation for the use of its money will not be less than the rate of 4 per cent per annum.

Changes in prospect

At the end of the first six months following the passage of the Relief Act the R.F.C. had authorized loans amounting to $147,000,000 for self-liquidating projects and had actually paid out $16,000,000. It had paid out $13,000,000 for highway construction and $85,000,000 for other federal public works. In

addition, the corporation has loaned $104,000,000 to states for direct relief, some part of which has gone into construction work, chiefly on roads. Over $4,000,000 has been paid out for forest roads and trails, $600,000 for roads in Indian reservations and $400,000 for Coast and Geodetic Survey work.

Except for loans to states for direct relief work, the activities of the Reconstruction Finance Corporation under the Relief Act were largely at a standstill at the opening of 1933. This was due chiefly to the fact that legislation looking toward liberalization of the Relief Act was being considered by Congress and applicants for loans were not pressing their claims in the hope that the new year would bring changes which will facilitate getting their work under way.

Amendments to the Relief Act now being considered include elimination of the self-liquidating limitation on public works and granting to the directors of the R.F.C. broader discretionary powers in determining what are necessary economical projects, elimination of the restrictions against supporting projects financed by the R.F.C. out of taxes, reduction in interest rates (somewhat in line with the plan for reduction in rates announced by the directors on Dec. 24), and widening of the classification of privately-owned utilities that may be financed by R.F.C. loans.

Active Invention Brightens the Equipment Field

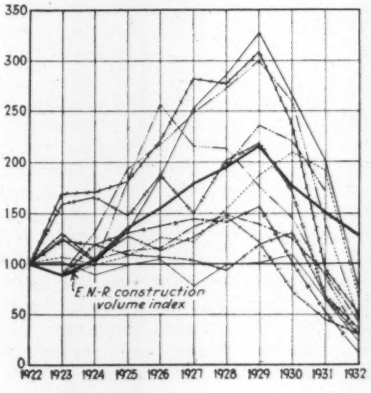
Depreciation of contractors' plant necessitates active replacement purchasing as construction increases—Invention progresses to meet the call with improved machines

APPRAISAL of the record of construction equipment in 1932 separates into three phases: (1) present condition of equipment in users' hands—i.e., existing contractors' plant, (2) equipment production and sales, and (3) equipment invention and improvement. Close estimates are difficult to arrive at in all three phases. Precise figures are impossible. The equipment owner is reluctant to admit depreciation of plant, the manufacturer is prone to overestimate invention, and the seller is inclined to exaggerate deflation in the market.

Withal the records of 1932 show, in the face of a discouragingly poor market, increased depletion and depreciation of equipment in users' hands, which promises an active future replacement market and wide activity by manufacturers in improving their products, foreshadowing in the future greatly increased contractors' plant efficiency. In brief, notwithstanding almost vanished sales, the morale of the equipment maker has not broken down, he has not abandoned invention and improvement, and he can see continued need of his undiminished activities.

These conclusions are based on evidence provided by a wide inquiry made by *Engineering News-Record*. This inquiry has included a sufficient number and variety of contractors, manufacturers and dealers to give a fair cross-section of the equipment industry. The results are summarized first for condition of equipment in users' hands, then for production and sales, and finally for advance in invention and improvement of equipment.

Representative manufacturers' sales volumes of equipment with relation to the construction volume as shown by the *Engineering News-Record* index.



Equipment condition

Because of very limited purchases during the years 1931 and '32 of new and replacement units, equipment in the hands of contractors has deteriorated. The general truth of this statement is a fact of common observation and also follows from logical reasoning. Depreciation is due both to obsolescence and to deterioration by wear, neglected maintenance and rust. Depreciation from obsolescence is difficult of appraisal and can be expressed only in the general statement that very few equipment units of 1933 production are not functionally superior to and structurally improved over previous types and patterns, and that new machines have been developed for operations for which machines have not previously existed.

Equipment condition due to deterioration admits of somewhat definite determination. In 1932 a questionnaire listing 320 items of equipment was addressed to contractors who had done work in 1931, and complete replies were received from 32 building contractors and 195 contractors for other than building work. A study of the replies indicated that the firms answering represented the most progressive in the contracting business and might reasonably be expected to have the best-conditioned equipment. The condition of equipment reported may therefore be assumed to be certainly not worse than the average. Since in most cases the condition reported was that of early in 1932, it assuredly suffered further loss during the remaining months of the year. Briefly then, the conditions recorded probably do not understate those as of the close of 1932.

Tabulation of the returns goes beyond reasonable space for publication, and in addition many of the items are of minor significance except as they were needed to build up the broad picture. Summarized, the 227 contractors reported *50 per cent or more of their equipment to be in poor or only medium condition.* Selected items of equipment as reported are given in the accompanying Table I. Substantially half the equipment in contractors' plant was in a condition of deterioration to call for immediate or early replacement upon active resumption of extended work. The depreciation from obsolescence was a much higher percentage. Incidentally the Census Bureau valuation in 1929 of all equipment possessed by contractors doing work annually of $25,000 or more was $449,000,000.

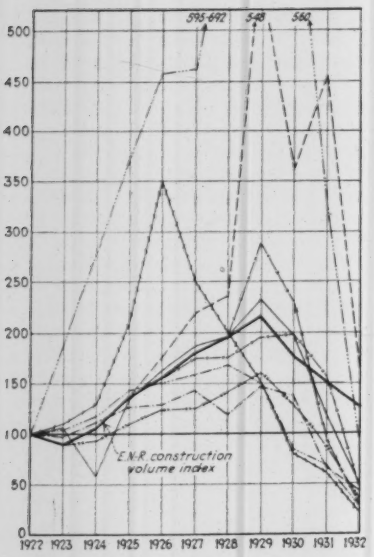
Equipment sales

Confirming the evidence of their own reports that contractors have let their equipment run down, is a record of decreased equipment sales beginning with the drop in construction in 1930 and reaching a maximum in 1932. Reports

TABLE I—DEPRECIATION ESTIMATES ON SELECTED EQUIPMENT UNITS OWNED BY CONTRACTORS

(Based on reports from 227 contractors on 320 equipment items)

Item	Contractors Reporting	Units Reported	Medium or Poor Condition
Automobiles (company)	156	669	366
Boilers	57	171	155
Clamshell buckets	89	228	133
Dragline buckets	48	154	67
Portable compressors	100	234	134
Gas crawler cranes	64	111	70
Leaning wheel graders	54	123	73
Concrete mixers	90	283	112
Paving mixers	83	150	77
Riveters	41	825	434
Gasoline centrifugal pumps	91	195	84
Concrete carts (steel)	91	947	553
Portable crusher plants	29	41	19
Derricks (all kinds)	96	210	134
Finishing machines (highway)	52	89	51
Road rollers	188	257	170
Power shovels	99	204	104



Representative distributors' sales volumes of equipment units relative to the construction volume as shown by the *Engineering News-Record* index.

to *Engineering News-Record* from 28 distributors and 21 manufacturers (based on 1922 sales) of their sales volumes each year for ten years show clearly the reduction due to depression. Various ways are possible of breaking down the report data: by volume of sales of parts, of complete units and of parts and complete units combined or by distributors' sales and manufacturers' sales, but all charts show substantially the same trends and two only are presented. They show equipment sales alone by manufacturers and by distributors, each curve representing a report and being on a relative basis with the construction volume curve based on the *Engineering News-Record* index.

The charts show only relative sales-volume trends. Production by value is not indicated, and such figures are not available for 1932 and not in accurately segregated form for previous years. From the Bureau of the Census, however, there are figures of production by value of all "machinery" in 1931 compared with 1929. The term machinery as used by the census bureau is so all-embracing, including such products as aircraft, motor vehicles and mechanical refrigerators, that its totals are of indicative significance only, but presented for such value as they have, were $6,609,907,686 in 1929 and $2,860,592,830 in 1931, or a 56 per cent decrease. By segregating the machinery items that may be classed definitely as construction equipment not grouped with other machinery, we have derived the accompanying Table II. The decrease in product value is close to 50 per cent.

TABLE II—DECREASE IN VALUE OF CONSTRUCTION EQUIPMENT

(From Bureau of Census report on machinery production in 1929 and 1931)

In Thousands of Dollars

Item	1929	1931
Concrete mixers	$11,405	$4,316
Crawler cranes	57,840	18,353
Hydraulic dredging machinery	1,358	1,224
Other dredging machinery	2,283	2,296
Power shovels	43,348	18,609
Draglines and power scrapers	7,242	4,401
Trench excavators	2,427	1,022
Other excavating machinery	4,086	2,634
Road graders	15,754	9,619
Road rollers	3,892	2,919
Stone crushers (road)	3,241	4,556
Other road machinery	7,805	10,120
Totals	$160,681	$80,069

With a sharply dropping sales curve during 1932, the equipment product values will show a further drop. In all ways the equipment sales records for the last year confirm the factual evidence and general observation that equipment in the hands of contractors is in a condition of deterioration and obsolescence that predicates a large replacement task as construction swings upward.

Improvement active

Decreased demand has not suppressed the creative spirit of equipment engineering. Instead it has made it more alert and inventive in devising products designed to tempt buyers. From a survey of manufacturers' activities a selection has been made of 30 manufacturers on the basis of wide geographical distribution, variety and volume of products and accuracy of their records. The results of this survey are summarized in the accompanying Table III first on the basis of general character of product development and second on the basis of design factors emphasized.

TABLE III—SPREAD AND TRENDS OF INVENTION AND IMPROVEMENT OF CONSTRUCTION EQUIPMENT IN 1932

(Based on reports from 30 representative manufacturers)

General Character of Product Development	
New products in present line	23
New products in a new line	17
Designs for higher price class	5
Designs for lower price class	14
Re-designs chiefly for lower manufacturing costs	6
Designs to provide a greater number of styles or sizes	9
Designs to widen the range of use of the machine	19
Design of new-purpose equipment	7
Design Factors Emphasized	
Higher speeds of operation	14
Larger-capacity units	15
More automatic operation	10
Greater precision in use	9
Less power consumption	12
Improved gearing	7
Better control	15
Devices or materials to minimize vibration	8
Improved lubrication	4
Adoption of corrosion-resisting materials	4
Closer manufacturing tolerances	4
More easily replaceable units	6
Re-styling for new form	5
Improved color schemes	4
Materials for improved appearance	5

The activity in creating new products is particularly impressive and, rather surprisingly, it includes designs for the higher-price as well as for the lower-price lines that might be expected to be emphasized as appealing most strongly to a reduced-income group of purchasers. Activity in providing more numerous styles and sizes and in widening the range of use of the machine does, however, indicate an appeal in part to a less well-financed market, but in part also it represents the continuation of a development trend of several years' existence. The considerable activity in creating new-purpose equipment is probably more truly a result of changing construction practices than of any market condition.

It is the evidence of the second part of the tabulation relating to improvement of mechanical functions that is most important as an index of equipment engineering activity. Definite improvement has been made in almost every one of a dozen vital machine qualifications and functions. As a result the equipment buyer obtains greater operating speed and capacity with less consumption of power, greater automaticity and better control, greater precision in use and definitely better machine qualities in improved gearing, materials and devices to minimize vibration, corrosion-resisting materials, closer manufacturing tolerances, improved lubrication and more easily replaceable units. And finally he gains the perhaps not negligible advantage of a positive effort to improve the appearance of his machines.

A summary of the means employed to bring about these gains has to be in very general terms, as how and in what degree each has been adopted depends upon the objective of the designer and the character of the product. Outstanding are better studied design and the greater use of special metals. Design has turned to rationalization to produce lighter weight without sacrifice of strength and effective performance. Better stress arrangement has been supplemented by the adoption of welded box or tubular sections for rolled shapes and of cellular for solid castings. Alloy steels have been widely called upon, the hard alloys as manganese for elements subjected to severe wear and the light alloys where saving in weight was the especial objective. Notable examples of the last purpose are aluminum booms for large excavators and combination aluminum and steel dragline buckets.

In the smaller machine parts design has contributed to reduced weight and mass by mechanical refinement. Examples are cut gears, non-friction bearings, closer tolerances, electrical control, synchronizers, V-belt drives, shock absorbers and cushion stops. These have contributed, like the larger weight reductions in the machine structure, to higher operating speeds and reduced power consumption.

Power units in particular have received study, but less to reduce weight than to secure fuel economies, reduce vibration, secure smoother transmission and insure more simple control. Extension of diesel power units and diesel electric units, with Ward-Leonard control, has been particularly noticeable. Lightening of machine weights, better oiling, reduced vibration, shock absorption and anti-friction bearings have made lighter power units practicable without reducing performance.

Nature Made a Good Record in Last Twelve Months

A summary of federal bureau records for 1932 shows generally favorable weather and climatic conditions throughout the United States

By John C. Hoyt
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WITH respect to activities over which man has control, 1932 will pass into history as an abnormally unfavorable year. Statistics indicate, however, that with regard to natural phenomena ordinarily considered in the class of "acts of God," conditions were not unusual and were generally favorable. Statistics collected during 1932 by the U. S. Weather Bureau, U. S. Coast and Geodetic Survey, U. S. Geological Survey, and other governmental agencies, relative to these phenomena indicate the following:

Precipitation, streamflow and floods

After two years of low precipitation, during which new minimums were established in many localities, precipitation for the year approached or was above normal. With the exception of Pennsylvania, Ohio, portions of states in the upper Mississippi and Missouri drainage basins, and in the Pacific Southwest, precipitation for the year was above normal. In only four states was the deficiency more than 10 per cent. With the exception of Florida the precipitation in the South Atlantic, lower Mississippi Valley and Gulf States ranged from 5 to 27 per cent above normal. The Pacific Northwest, Idaho and Montana also experienced high precipitation, which ranged from 1 to 20 per cent above normal.

Streamflow for the year as a whole showed a marked increase over the flow for 1930 and 1931. The average annual flow for all the streams on which data are kept in the United States hovered around normal. Streams in the lower Appalachian region, Delaware, Connecticut, Nebraska, Kansas, Texas and in the Southwest experienced high flows. In the other extreme, unusually low flows were reported in the Middle Atlantic states, from the Western lake region to the Rocky Mountains north of the 37th parallel and in parts of the Great Basin. In the sections not mentioned streamflow was above normal.

Floods were quite numerous but were widely scattered and of local character. Except in the Yazoo Basin and along the Ouichita and Lower Red River basins damage was not serious in the early spring and summer floods. The year closed with damaging floods in the South Atlantic and East Gulf states, and in the rivers of Tennessee and western Kentucky. The lower Ohio was rising, but up to the end of the year there had not been sufficient precipitation to cause a Mississippi River flood.

Reservoirs, groundwater and crops

In the arid West the reservoirs, which were greatly depleted during the drought of 1930-31, ended the year with a gain in stored water. Out of twenty U. S. Bureau of Reclamation reservoirs, nineteen showed an increase in storage for the year ending Oct. 31, 1932. Although this increase amounted to 22 per cent of the capacity of these 20 reservoirs, the total storage at this time only amounted to 35 per cent of the ultimate capacity (8,976,500 acre-ft.).

Generally throughout the United States, groundwater levels were higher in 1932 than in corresponding periods for 1931. However, extreme low levels were reached in parts of that region extending from the Mississippi Valley to the Rocky Mountain. Groundwater levels above normal occurred in parts of the Middle Atlantic states, Southeastern states, southern California and the Columbia River basin. Subnormal levels prevailed in all other sections that reported rises in the water table.

There was adequate water to satisfy the needs of vegetation in practically all sections of the country. The yields of crops per acre were 98.6 per cent of the ten-year (1919-1928) average. Colorado and Florida had the lowest percentage yield, being 76 and 79 per cent respectively. However, there were only eight other states that recorded percentages below 90, and these were in the Middle Atlantic states and the central plains.

Probably one of the best general indications of annual and seasonal changes in streamflow is the variation in the monthly and annual production of electricity for public use by the use of water power. The changes in total annual production of electricity, as shown in the accompanying table, indicate that there was a decided increase in output from 1928 to 1929 and a decrease each year thereafter, with increasing intensity to 1932. The output by water power, however, showed a decrease in output from 1928 to 1929 and a decrease each year with increasing intensity to 1931, reflecting the general decrease in the flow of streams during these years due to drought conditions. In 1932 there was a marked increase in the production of electricity by the use of water power due to the increase in the flow of streams brought about by the end of the drought and the return to normal precipitation.

PRODUCTION OF ELECTRICITY FOR PUBLIC USE BY WATER POWER, FUEL POWER AND THE TOTAL FOR THE PAST FIVE YEARS, IN MILLIONS OF KILOWATT-HOURS

Year	Total	Change	Water Power	Change	Per Cent of Total	Fuel Power	Change
1928	87,850	.....	34,696	.....	39.5	53,154	.....
1929	97,352	+10.8	34,629	— 0.2	35.6	62,723	+18.0
1930	95,936	— 1.5	33,021	— 4.6	34.4	62,915	+ 0.4
1931	91,729	— 4.4	30,603	— 7.3	33.4	61,126	— 2.8
1932*	83,000	— 9.5	34,000	+11.0	41.0	49,000	—20.0

*Estimated.

Temperature and earthquakes

The only outstanding feature of the year with regard to temperature was the unusually mild weather during the three winter months beginning December, 1931. This condition was quite general throughout the United States. During the three spring months temperatures were very nearly normal in all sections of the country, with the exception of a short period in March when freezing weather was reported as far south as the Rio Grande and Gulf Coast. During the summer months the temperature was slightly higher than normal in most sections but was not excessive. During the fall months temperatures were somewhat above normal in the Mississippi and lower Rio Grande valleys, and normal or slightly above in the Eastern states.

There was an unusually large number of tornadoes and cyclones in various parts of the country. Fortunately, however, these did not strike large centers of population.

During the year the United States had unusually few earthquakes, and these were of comparatively low intensity. East of the Rocky Mountains there were only two worth mentioning, with no damage in either case—Saranac Lake, N. Y., on Dec. 6, and Mexia, Tex., on April 9. In the Western mountain region there were moderate shocks at Dillon, Mont., March 21; Jackson, Wyo., Jan. 26; and Salt Lake City, Utah, Nov. 12. Pacific Coast activity was considerably below average, the heaviest being that at Eureka, Calif., on June 6, with some damage to property. Walls were cracked at San Jose on Nov. 3. There were other shocks at Brawley on Oct. 9 and in the San Francisco Bay region on October 24. There were several moderately strong shocks in western Washington, notably those of July 17 and Aug. 6.

Contracting Ends Year with Increased Stability

Greatly curtailed business in 1932 met by revamping organizations and a hopeful swing to promotional selling of construction services

HOW HAS the contracting business met the third year of depression? In 1930 the operations carried over from 1929 and the inertia of the boom movement of the previous two years kept construction at a moderate pace and contractors reasonably busy. Real lack of work began in 1931 and reached its maximum in 1932. Built up to the large-volume and high-speed production of boom years, the contracting business had a strenuous task of deflation and retrenchment to carry out. The year just ended saw the culmination and end of this undertaking, and this is the story of contracting in 1932. In brief, in its third year of depression the contracting business has been obliged to adjust itself to an entirely new order of things.

Little work and low prices

It is common knowledge that contractors in 1932 had comparatively little work. An impressive quantitative indication of the fact exists in the construction volume figures given in a preceding article. For a more personal picture, experiences were secured of contracting groups distributed to represent different sections of the country and different kinds of construction activity. In respect to business activity the information obtained was only broadly quantitative, but it presents a sharp picture of deflated markets.

Builders generally have suffered worse losses than contractors for engineering construction. Of a dozen groups of building contractors only two were found in which more than 25 per cent had been reasonably busy in 1932; in none of the others were there more than 10 per cent who could be included in this classification. From 5 to 40 per cent had done a moderate amount of work, and from 60 to 90 per cent had done little or no work.

The percentages of engineering contractors moderately or quite busy were considerably larger; this was particularly true of groups largely made up of highway contractors. In fact, road-building has proved a factor that has saved the engineering contractor from registering as great a loss of business as has the builder. Contractors for municipal and public utility construction have suffered as much from general idleness as have builders.

The prices at which work has been contracted are felt to have been lower than construction costs have justified. Several groups emphasized this complaint more strongly than that of lack of work. The reasons given are: more bidders for the fewer jobs, willingness of many contractors to forego profits or even to take a loss to keep their organizations intact, and invasion of the business by outsiders such as logging outfits and materials producers, who, owing to the generally small run of contracts, could organize to handle the work with little investment in equipment. These guerrilla forces are particularly complained of by some of the groups questioned.

Stability improved

Generally, contractors have met the dearth of work by drastically reducing organizations. Some attempt was made in 1930-31 to keep skeleton organizations, but this purpose was abandoned as inability to secure contracts continued and increased. In 1932 the great majority of idle contractors had reduced forces to the owners of the business and a stenographer and had laid up the plant that they had been unable to sell or rent. Offices were closed and business activities were conducted from their homes. In brief these contracting businesses continued only in name, and employment by them virtually ceased to exist.

Those contractors who continued to get some work or were reasonably busy have retained organizations adequate to the volume of work in hand, but even they have pruned their organizations of every part not absolutely essential to the conduct of the work. Low contract prices have not permitted any contracting organization to carry excess fat. In considerable measure this has been good for the contracting business, as also has the mortality that depression has brought.

The three years of depression have brought about a substantial reduction of number of contractors. Never a long-lived business (according to the Bureau of the Census report on construction, only 75 per cent of the contractors recorded as of 1929 had been in business over five years), its resistance to the epidemic of deflation was weak. Statistics are not available, but every group of the full score investigated reported a loss of members going out of business or forced out of business. A greater number had become insolvent or without credit.

This reduction of units and, in cases of forced retirement, of probably the more irresponsible units has given greater stability to the business. Like forced reduction of directing and service organizations the reduction of contracting units by forced retirement appears in one light as a healthful purge clearing the contracting business system. As construction resumes there will be in general a better organized and more responsible class of contractors to take on the work.

Promotional selling

Accustomed only to competitive selling, the contracting business, with the growth of depression, found itself confronted with the necessity of promotional selling if it were to make sales. It has taken hold of the task a little tentatively and rather awkwardly, but withal, its efforts indicate one of the most hopeful awakenings of the business for which the depression is responsible. Quite generally this selling movement has taken the directions of developing widespread repairs and improvement of buildings commonly of the smaller classes and of modernizing larger buildings or converting them to different purposes. The argument for such activity has been, in some cases, unemployment relief, but more generally it has stressed the economy of present prices and wages and of preserving capital investment by conversion to higher income classes. Where all property and construction interests have combined their forces unreservedly in such activities they have been fairly successful.

The chief obstacle to success has been that of financing. Almost every group of contractors that was found to have undertaken a modernization campaign had met the complete refusal of financial institutions to lend money for capital improvements. Somewhat more liberality had been shown by such institutions in modernizing property on which they had foreclosed. Without ability to borrow for improvements, property owners were unable to go along generally with any modernization movement.

Summary

To summarize briefly the circumstances of the contracting business in 1932, it is found that only a small percentage of its units have been really active, a larger number (perhaps a third) have had some business, and the majority had little or no work. There has been a general scaling down of business organizations and large mortality from voluntary and forced retirements. Noticeable activity has been shown in promotional selling, with only moderately successful results because of bank embargoes on capital loans.

Professional Problems and Unemployment

Drastic curtailment of construction in 1932 brought widespread unemployment and distress to many civil engineers—Some brighter prospects for 1933

ENGINEERS of all kinds began to feel the full effect of business depression as the year 1931 drew to a close, but the significance of what was taking place was not widely recognized. Only in the larger centers where unemployment among engineers reached serious proportions in the early fall was it realized that many members of the profession would be in dire need before the winter was over. In these centers, relief measures were organized but they were of a temporary nature, predicated on the expectation of better times in the spring. But with spring came only a minor revival of work upon which engineers depend for a livelihood; there was not enough work to give a desirable amount of employment to those still in private practice or employed by engineers and contractors and not nearly enough to give work to the engineers still out of employment. The profession awoke to the fact that it was faced with a major readjustment.

Engineering declines

The civil engineering profession falls into three general classes: those in private practice as consultants or contractors, those in the employ of the two foregoing groups and those in public service. Of the three, the first two have suffered greatly during the past year. Private consulting practice was probably at the lowest point on record, and although most of the engineers in that field have managed to keep going, they have had little or no business.

Another group to suffer heavily was that making up the engineering staffs of public-utility holding companies. The boom days preceding 1930 saw the setting up of large organizations for centralized engineering service to the operating subsidiaries of holding companies. These engineering departments generally survived the early part of the depression, but last year as the weakness of the holding company set-up became apparent most of them were cut drastically or entirely eliminated, the reduced engineering work being transferred to the forces of the operating companies. Construction units similarly set up passed out of existence, putting many engineers out of work.

Engineers in state and municipal employ have fared better than those in private employ. A considerable number of those engaged in the construction of fixed improvements have been laid off as the result of the drive to cut public expenditures, which progressed continuously through the year; but generally engineers in municipal and state service suffered little from the depression. Pay cuts have been made, but few have been more than the drop in living costs. Engineers on temporary work, of course, have suffered through the curtailment of such construction. In New York City alone the Board of Transportation dismissed several hundred men, mostly engineers.

Federal service appears to be the least affected. Few engineers have been laid off, and such cuts as have been made in pay have been offset by lower living costs.

Relief measures

Commendable evidence of the solidarity of the profession developed early last winter when it became evident that unemployment among engineers was becoming critical. Begun in a small way by the separate professional groups, the relief movement in most centers of population developed into united action in which all local engineering groups joined. Further, the relief work was not limited to society membership. In so far as possible, relief was extended to all engineers.

Although a few engineers began to realize by the late summer of 1931 that some measure of relief would be needed during the coming winter, the relief movement did not begin to take definite form until a small group of engineers in New York City, concerned over the increase in unemployment among members of the profession there, brought the matter to the attention of the board of direction of the American Society of Civil Engineers.

Under the stimulus of the movement started within the A.S.C.E., planning for relief work was begun in many centers of population, generally as a cooperative undertaking of local sections of the major engineering societies, regional societies or engineers' clubs. Relief work of some form was carried out by the Oregon Technical Council for the Portland region, at San Francisco, San Diego, Los Angeles, Denver, Kansas City, Topeka; in Arkansas, at St. Louis, Minneapolis, St. Paul and Milwaukee; in Michigan as a state-wide undertaking, at Columbus, Cleveland, Cincinnati, Pittsburgh, Birmingham and Atlanta; in Maryland as a state-wide operation, at Philadelphia, Trenton, New York, Providence and Boston.

Especially notable was the relief work done at Boston, New York, Trenton, Cleveland, Columbus and Denver. The methods adopted all were different, being adapted to take advantage of local conditions. At Boston, where architects and engineers combined forces, direct employment was given to 376 of the 1,262 registered, and positions were found for 171 others. Those directly employed by the relief bureau collected data that ultimately will be needed in city and regional planning work, made many surveys and maps for public institutions and did like work of a non-competitive nature. In the New York metropolitan area 2,188 men registered, and work was found for 1,514, the work covering a wide range such as research, supervising gangs of laborers in the city relief operations, and U. S. topographical surveys. The total amount raised was nearly $119,000; and the value of the relief work, including wages paid men placed with other agencies, in private employ, etc., amounted to $874,000.

At Trenton a county traffic survey was organized, chiefly through the efforts of the unemployed themselves; at Cleveland a truck-farming community was organized in the early spring, and work was provided for men who would do farm work; and at Columbus work was found for a considerable number of the unemployed on bridge work undertaken by the highway department.

Engineering in the year ahead

Prospects for the new year are little brighter. Liberalization of the Relief Act may spur many communities into undertaking the construction of needed improvement works, and the designing and building of them should provide work for not a few engineers; but it is likely that pressure will be brought to bear on city engineers to do as much of the work as is possible with their own forces. Appraisal work for the Reconstruction Finance Corporation in connection with loans under the Relief Act and revaluation of the properties of public utilities also may provide work for a considerable number of engineers.

Private construction work in 1933 should be no worse than 1932, and there are indications that it may be better. The course of heavy engineering construction indicates that the steady decline of 1931 has changed to horizontal if it has not actually begun to rise.

Over against these more encouraging signs must be set some discouraging ones. Highway work is almost sure to be less this year than last. The federal-aid budget has been cut, state budgets are being cut, and gas-tax money that should go into roads is being diverted for other purposes. Also the federal building program is past its peak, and little new money is available. Pressure still is being brought to bear on municipalities to cut expenses, and engineers

are among the first to go when new work is eliminated. The engineering profession must adjust itself to the new conditions brought about by a cut in the total volume of construction—from more than eight billion dollars in each of the five years prior to 1930 to a volume in the neighborhood of three billion dollars.

New Problems Arise in the Engineering Colleges

With reduced income, smaller entering classes and more graduate students, the colleges maintain their programs but some see evidences of a need for change—Faculty salaries have been cut, staffs reduced, and some research affected

FOR THE first time in many years the engineering colleges are feeling the influence of economic and industrial changes. Financial conditions and reduced demand for the output of the college are the prime causes. To date, the extent of influence has been limited, but there are signs that educators are becoming conscious of the possibility that there may be a basic change in the service demands that the engineering college has to meet, and that evolutionary changes in the educational plan and program may be called for.

The broad facts of the present situation in the engineering colleges are these: Income has decreased nearly everywhere, although the decrease has varied widely. There are more upper classmen in attendance but fewer entering students. Recent graduates have experienced great difficulty in finding positions and many of them are entering non-engineering work. An inquiry directed to a representative group of colleges indicates that the difficulties may continue to grow for some time.

What the colleges report

More in detail the inquiry brought out the following: All institutions other than endowed schools report reduction in income but generally no decrease in enrollment. Nearly all report that there are fewer entering students but that this decline is balanced by an increase in the upper classes and in the graduate department. Economies have been made in general administrative expense, sometimes also in maintenance of buildings and equipment. In many cases faculty salaries have been reduced. There have been practically no deliberate reductions in teaching staffs, although in many cases vacancies have been allowed to remain unfilled. Students have less money, more of them seek work for self-support, and loan funds are heavily taxed. A marked increase in the seriousness of students is noted and instructional results are much improved. Curriculum modifications occasioned by the new conditions have been slight.

No material decrease in enrollment has been noted at the endowed schools. At Columbia, enrollment in the engineering school has increased; at Massachusetts Institute of Technology a slight decrease has occurred in the enrollment in the graduate school.

Although the University of California has an increase in number of students, the state universities generally show a greater drop in enrollment than do the endowed schools, mainly in the entering classes. In all these schools there are more graduate students enrolled; at Iowa the number has quadrupled in two years. Personal financial difficulty is in evidence among the students at many of the schools, and personal expenditures have been reduced to bare essentials. Placement of engineering graduates, not surprisingly, has been made only with great difficulty. Less than 30 per cent of the 1932 engineering graduates at the University of Michigan had found jobs by the end of the summer.

Endowed engineering schools reported no salary cuts, and in at least one case the policy of annual increases has been continued. At M.I.T. a reserve fund has been set up by contributions of 10 per cent of salaries over $500 to meet a possibly abnormal operating deficit; if no such deficit occurs, the fund will not be drawn upon.

Effect of biennial appropriations

As they are largely dependent for support upon annual or biennial appropriations made by state legislatures, the engineering schools of state universities have felt the effects of the depression more keenly. A marked reduction in income is general. Some schools are still operating on funds made available before the depression had cut so deeply into state income, but reduced support is being anticipated in these cases and sails are being trimmed accordingly. At California, for example, the state has requested the university to return voluntarily a definite sum from the current approved budgets of 1932-1933, including a voluntary reduction of 7½ per cent on all salaries exceeding $2,000. The appropriation made for the support of the University of Iowa was reduced two years ago, and salaries at that institution have been cut 5 per cent. The staff has also been reduced. The University of Minnesota has so far been able to avoid drastic salary reductions, although general retrenchment and curtailment of activities have been necessitated. In other schools staff salaries have been reduced, in some cases as high as 20 per cent. At Cornell vacancies have been left unfilled, and no promotions have been made. Staffs have been reduced at both Kansas State College and Agricultural and Mechanical College of Texas.

As to program

Research in most of the schools has been somewhat curtailed. Thus, at M.I.T. the minor research problems have been restricted; at Johns Hopkins only those special research projects supported by outside industrial agencies have suffered; at Columbia it is expected that research activities will have to be slowed down in the near future because of reduced income. Despite great efforts to maintain research work in the state universities there has been some curtailment; purchase of equipment has been largely impossible and in some cases the reduced staff acts as a further handicap. Research conducted by the state universities on a cooperative basis has not been materially affected. California again reports the fortunate result of being able to maintain its research work unimpaired.

Few changes have been made in undergraduate courses. Curriculum requirements have in all cases been maintained as high as before, but there have been some reductions in the number of special and elective courses. Pennsylvania State College, for example, has suspended its courses in railway mechanical engineering and flour mill engineering. At Texas A.&M. some of the courses that differ only slightly from each other are being combined so as to serve a larger group.

What permanent effect upon educational policies may result from present business conditions cannot be foreseen, and the replies on which the present article is based do not reveal whether or not any such effect is looked for. It is evident that a few educators are conscious of the extent to which, under the sharply reduced demand of the last two years, the supply of graduates exceeds the requirements of engineering work, and look toward a broader educational policy so that the student may find himself equipped for a wider range of activities. Meanwhile the cost of conducting highly specialized courses appears to be becoming an increasing burden. It may prove, therefore, that current events will lead to a reappraisal of the function of the engineering college and to the development of a modified educational program.

NEWS OF THE WEEK

Rail and Road Men Report on Highway Control and Costs

CONSIDERABLE agreement as to what control should be exercised over motor transportation and as to how highway construction should be financed is found in the report made public on Jan. 30 of a joint committee representing the Association of Railway Executives and the National Highway Users Conference. The report is signed by W. W. Atterbury, president, Pennsylvania Railroad, and Alfred H. Swayne, vice-president, General Motors Corp., chairman of the two groups making up the joint committee.

The committee opposes legislation which has as its purpose the stifling of any legitimate form of transportation and favors regulation of all users of highways for commercial purposes. Common carriers in interstate commerce should be placed under the jurisdiction of the Interstate Commerce Commission and should be required to obtain certificates of convenience and necessity based upon (a) the need for the service, (b) its quality and permanence, (c) need for continued existence of existing services, (d) adequacy and possibility of improvement in existing services, (e) effect of new service on the old, and (f) financial responsibility of the applicant.

Highway cost distribution

On the matter of highway costs the committee agreed that motor vehicles should pay the entire cost of the state highway systems and, in addition, a part of the cost of county or township roads to be determined by the extent to which they are generally used. It was agreed that motor vehicles likewise should contribute to the cost of arterial routes through cities.

The annual cost of the highways should be divided among private automobiles, buses and trucks according to the use of the type of road required by each group. Each would pay a base tax covering the cost of building and maintaining roads designed for private passenger cars. The additional cost of making the roads suitable for buses and trucks would be assessed against them. The proportionate share of each group of vehicles would be converted into a gasoline tax on all and a registration fee graduated for passenger cars according to weight or horsepower, for buses according to mileage and seating capacity, and for trucks so that it will increase more than directly with the weight.

The question of regulating truck rates is left wide open because the highway group insists that there isn't sufficient evidence to show that this is desirable or desired by the public. Common carrier buses would be required to adhere to reasonable and non-discriminatory rates and contract buses to minimum rates fixed by regulatory authority.

With reference to limitations on the length and weight of vehicles, the highway group accepted the code adopted by the Association of State Highway Officials and the U. S. Bureau of Public Roads. The railroad men asserted that this should be left to the state regulatory commissions and refrained from any definite recommendations for uniform application.

The railroads' right to engage in motor services, either directly or through subsidiaries was recognized even to the extent of recommending that the anti-trust laws be modified, if necessary, to permit railroads to purchase truck or bus lines already in operation.

With reference to grade-crossing elimination the committee advocates repeal of all state laws requiring the railroads to make expenditures greater than the savings that actually accrue from elimination of such crossings through elimination of flagmen or mechanical equipment.

Puget Sound Bridge Proposed

Plans for the construction of a bridge across the Narrows, an arm of Puget Sound between Tacoma and Bremerton, have been approved by the Army Engineers and approval of the Secretary of War is expected to follow. A central span 1,200 ft. long with a clearance of 196 ft. is called for in the approved plan. The bridge is estimated to cost $3,000,000. E. M. Chandler, Olympia, Wash., is the engineer.

Columbus Street Cleaning Now Paid for by Gas Tax

Street cleaning in Columbus, Ohio, was discontinued on Jan. 21 because no funds for the payroll were available and was resumed on Jan. 24 after the mayor had signed an emergency ordinance diverting $15,000 from gasoline-tax funds to the street cleaning division.

Heretofore street cleaning in Columbus has been financed by the issuance of bonds which were repaid by a street-cleaning assessment on property owners. The recommendation made by the mayor last November that bonds for 1933 street cleaning be issued still remains in committee in the city council without having been acted on. The council plans to support the street cleaning department from general taxation but the 1933 budget will not be adopted for the next two or three weeks. When the available funds became depleted the city auditor stopped payment on the street-cleaning payroll.

An emergency ordinance was then passed by the city council to provide funds to run the street-cleaning operations until the new budget is adopted. Immediately after the mayor had signed the ordinance, diverting $15,000 from the gasoline-tax fund, the 82 employees of the street cleaning department were called back to work. It is estimated that this amount will run the department for about six weeks.

San Francisco Bay Bridge Start Assured by Legislative Action

IMMEDIATE start on the $75,000,000 San Francisco-Oakland Bridge project has been assured by the unanimous approval of six bills by the California Legislature which were necessary to secure the $62,000,000 loan already approved by the R.F.C. With financing assured, the work will be rushed by the California Toll Bridge Authority and bids for the main west channel piers, already called, will be opened Feb. 28. Bids for other foundation and superstructure units will follow during March. The bridge will be a publicly owned toll structure across San Francisco Bay with provisions for vehicular and interurban traffic between San Francisco and the cities across the bay.

Setting a high mark for legislative cooperation on an important public construction project, the state legislature passed the group of bills within three weeks after the opening of the present session. Sponsored by the administration and backed by the solid support of the San Francisco Bay area, the bills were discussed before a joint committee of the two houses and were unanimously recommended. Opposition and possible amendments faded under overwhelming public approval and the Assembly and the Senate approved measures on consecutive days (Jan. 24-25) without a dissenting vote. The following day the bills were signed by Governor Rolph, completing the legal step necessary to permit actual start on the project.

Requirements to be met

The legal requirements set forth by the R.F.C. as prerequisite to the final approval for the $62,000,000 loan for this structure were finally condensed into six separate enactments. The important features contained in the bills provide:

1. State appropriation of $6,600,000 to build the two approaches. This money is to be taken from the northern counties gas tax allotment of the regular state highway fund during the next four years.

2. Inclusion of the bridge in the state highway system, after its completion, which will provide for maintenance of the structure, removing this item of annual cost from the income from tolls.

3. Reimbursement of the state for the $650,000 loan made to the Toll Bridge Authority for carrying on preliminary design work and foundation investigations.

4. Technical amendments to the State Toll Bridge Law, the law granting franchises for toll bridges, and the law governing the width of highways.

Opposition and suggested changes to the bills, which would have placed half or more of the $6,600,000 approach cost directly on San Francisco and Alameda Counties, were dropped in the interest of a

prompt start on the work. Following passage of the bridge bills, a measure was passed in the Senate which provides that after the bonds have been paid the tolls will be continued until the approach cost and the loan for preliminaries has been repaid to the northern counties gas tax allotment funds.

The bridge project has a total length of about 7½ miles and will span the 5-mile water barrier between San Francisco and the metropolitan area on the east side of the bay. Principal features consist of two 2,310-ft. suspension spans (with central anchorage) in the west channel, a 500-ft. tunnel through Yerba Buena Island and a 1,400-ft. cantilever span across the East channel. The project's history and the principal features of design were described at length *ENR*, Oct. 20, 1932, p. 457.

Bids called on pier work

Bids for the five main piers in the west channel, with an estimated cost of $8,500,000, were called Dec. 1 and are scheduled for opening Feb. 28. Bids for the 21 piers forming the substructure of the eastern section of the bridge have also been called and are scheduled for opening March 2. Present plans call for opening of bids on other sections of the main structure, including the island tunnel, before the middle of March.

E. E. Haskell, Former Dean of Engineering at Cornell, Dies

Eugene E. Haskell, prominent hydraulic engineer and dean of civil engineering at Cornell University at the time of his retirement in 1921, died at his home in Hamburg, N. Y., on Jan. 29, age 77 years. Mr. Haskell was a native of Holland, N. Y., and graduated from Cornell in 1879. Immediately upon graduation he went first to the U. S. Lake Survey and then to the Mississippi River Commission. In 1885 he joined the U. S. Coast and Geodetic Survey, devoting much time to the study of currents on the Atlantic Coast, during which time he invented the Haskell current meter. From 1893 to 1906 Mr. Haskell was engaged in reorganizing and directing the work of the U. S. Hydrographic Survey of the Great Lakes Basin. In 1906 he was appointed head of the civil engineering department of Cornell University. In the same year he was appointed a member of the American Section of the International Waterways Commission, which position he held until 1915. Mr. Haskell acted as dean of engineering at Cornell until 1921, when he was appointed emeritus professor of hydraulic engineering. From 1924 to 1925 he served as honorary chairman of the engineering board of review, Sanitary District of Chicago.

Construction Loans Approved by R.F.C. Total $1,598,000

LOANS totaling $1,598,000 were approved by the Reconstruction Finance Corp. on Jan. 28. The largest loan authorized was $1,300,000 to the Orleans Levee District, New Orleans, La., for flood protection work and the construction of an airport. The corporation agreed to purchase 5½ per cent bonds of the levee district.

A loan made possible through the purchase of $45,000 of 6 per cent revenue bonds at par was authorized for the city of Glen Rose, Texas, for the financing of a new waterworks and sanitary sewer system. A loan to Greenville, Miss., of $175,000 for the completion of a river freight terminal was approved, the corporation agreeing to puchase 5½ per cent revenue bonds. The city agreed to deliver to a trustee $25,000 of government securities for the purpose of caring for any deficit in principal or interest during the life of the loan.

Three small loans were authorized as follows: $38,000 to the town of Vernal City, Utah, for rehabilitation of the city's water system; $25,000 to the city of Cambridge, Ohio, for the construction of an intercepting sanitary sewer; and $15,000 to Long Pine, Neb., for an extension of its water supply system.

New loan applications

Application for a loan of $610,000 has been made to the R.F.C. by the Cape Lookout Highway, Inc., Beaufort, N. C., for the construction of a toll bridge and causeway connecting Cape Lookout with the mainland at Lenoxville Point.

Port work and wharf improvements are proposed by the city of Galveston, Texas, and it is expected that an application for a loan of $500,000 will be made to the R.F.C.

The city of Abilene, Texas, has applied to the R.F.C. for a loan of $400,000 for the construction of 130 miles of pipe line to bring natural gas to the city.

The San Benito, Harlingen, Santa Maria and La Feria Irrigation Districts of Texas plan to apply to the Reconstruction Finance Corp. for a loan of $400,000 to be used in the construction of a pumping plant on the Rio Grande to consolidate the public plants of the four districts into one plant for supplying the 120,000 acres in the district.

Application for a loan of $2,000,000 is being made by the Brownsville Navigation District. Dredging of the inner channel and turning basin is estimated to cost $1,000,000, terminal facilities $500,000 and right-of-way, railway connections and general expenses, $500,000. Dredging of the outer channel and construction of jetties by the federal government is expected to cost $2,158,000. The district will offer the R.F.C. $3,500,000 of its bonds as security for the loan. The dredging work was approved recently, as noted in our issue of Jan. 19, p. 96.

Construction of a sewage disposal plant at Bloomington, Ind., is proposed. The city plans to apply to the R.F.C. for a loan of $300,000.

In anticipation that the application for a loan of $3,500,000 for the construction of the Red Bluff dam on the Pecos River will be granted, bids for constructing the dam and spillway will be received Feb. 25, by the Red Bluff Water Improvement District. The site of the proposed dam is in New Mexico, near the Texas line and the water will be brought to lands in the Pecos Valley by means of a canal.

Olympia-Aberdeen Ship Canal Proposed in Washington

Plans for the construction of a ship canal from Olympia to Aberdeen will be laid before the unemployment committee of the Washington state legislature now in session. The project, according to Frank R. Nichols, engineer, would cost $37,000,000 and give employment to 20,000 men for two years. It is claimed the canal would be self-liquidating from tolls on tonnage passing through it, as steamers from Seattle to California would save 222 miles. Plans provide for a canal 200 ft. wide at the base, 300 ft. wide at the water surface, and 50 ft. deep. Figures show that 3,000,000 tons of shipping passed from Seattle and lower Puget Sound points in 1930. Effort will be made to have the legislature order the canal built by a state bond issue or by a loan from the Reconstruction Finance Corporation.

Maryland's Water Resources Discussed at Engineers' Meeting

Maryland's water resources and the uses that are now being made of them were outlined in a paper presented before the fourth annual meeting of the Maryland Association of Engineers at Baltimore, Jan. 26, by Abel Wolman, Chief Engineer of the State department of health. The paper summarized the results of the survey made during the past 18 months by the Water Resource Commission, of which Mr. Wolman is chairman.

The survey brought out that at present 1,250 million gallons of water are used daily in the state. Public water supplies account for 250 m.g.d.; power, 900 m.g.d.; and industrial uses, 250 m.g.d. It is estimated that the state's minimum requirements in 1950 will be 1,500 m.g.d.

One of the disturbing features of present conditions is that there is no controlling agency in the state to govern the competing demands upon the water resources by the various classes of users. Further, the state lacks an agency for control over dams.

Low Bids for Hoover Dam Gates

Bids for the cylinder gates and entrance liners for the intake towers at Hoover Dam, have been received by the Bureau of Reclamation as follows:

Entrance liners, bulwark head and sills, low bid, Goslin-Birmingham Manufacturing Co., Birmingham, Ala., $56,000; second low, Marion Machine Foundry & Supply Co., $74,120.

Upper and lower cylinder gates, nose liners, throat liners, gate seats, deflector rings, guide shoe structures, guide shoes, guide towers, guide tower supports, support rings and other appurtenances, low bidder, Westinghouse Electric & Manufacturing Co., $334,737, second low, Allis-Chamers Manufacturing Co., $369,000. There were two combination bids. The Westinghouse Electric & Manufacturing Co. were low with $412,316; second, Allis-Chalmers Manufacturing Co., $449,000.

It had been anticipated that foreign manufacturers would underbid American firms on these items but when the bids were opened it was found that no foreign firm had submitted prices.

Arthur N. Johnson Receives Bartlett Award

Arthur N. Johnson, Dean of the College of Engineering, University of Maryland, was presented the George S. Bartlett award of the Highway Research Board, the American Association of State Highway Officials and the American Road Builders Association at the banquet of the Highway and Building Congress in Detroit on Jan. 19. The award is given each year in recognition of outstanding highway service. Last year it was presented to Thomas H. MacDonald, chief of the Bureau of Public Roads.

Dean Johnson, a pioneer in highway engineering, was a member of the first class in highway engineering to be conducted in the United States, at Harvard in 1893. Shortly after becoming state highway engineer of Maryland in 1898, he mapped out a highway system for that state which is substantially its main highway system of today.

Following his seven years as state highway engineer of Maryland he became highway engineer of what was then called the U. S. Office of Public Roads. He served as state highway engineer of Illinois for twelve years, and later became consulting highway engineer for the Portland Cement Association. In 1920 he was appointed dean of the College of Engineering of the University of Maryland, a position he still holds.

Engineer Registration Law Proposed in Connecticut

Registration of engineers and land surveyors is proposed in a bill introduced into the general assembly of the state of Connecticut on Jan. 25. The proposed Connecticut law is of special interest in that it is taken almost verbatim from the uniform registration law for engineers as revised last year by the joint committee representing the major engineering societies.

A bill providing for the registration of architects also is being introduced into the Connecticut general assembly.

Water Diversion at Massena Declared a Local Issue in U.S.A.

Diversion of water from the St. Lawrence River at Massena, N. Y., is declared to be a local question in notes exchanged between the Canadian and United States goverments in January. The engineering plan upon which the Great Lakes-St. Lawrence Deep Waterway treaty is based includes estimates for the cost of providing for the continuance of the diversion by the Aluminum Company of America of water from the St. Lawrence River through the Massena canal into the Grass River for power development.

In order to make it clear that the signing of the treaty would in no way affect the rights of the United States Government or the State of New York or commit either or both of them to a continuance of that diversion, the State Department asked the Canadian Government to go on record as considering this matter one of purely local concern and unaffected by the treaty. The Canadian Government has agreed to that proposal and has joined the United States Government in a declaration of principle to the effect that the treaty, signed in Washington on July 18, 1932, "is not, in any respect, to recognize, confirm, or establish any rights or claims of any person or corporation, in respect to the diversion of water for power purposes through the Massena canal and Grass River, or to limit the freedom of the United States or the State of New York to treat the question of the continuance, control or elimination of such diversion as a domestic question."

Los Angeles Reduces Rate On Irrigation Water

The Los Angeles, Calif., city council has approved an ordinance reducing gravity water rates for intermittent irrigation use from eighteen cents per 1,000 cubic feet to fifteen cents per 1,000 cubic feet. The reduction will apply particularly to the San Fernando Valley ranching district, reducing water charges there by about $100,000 per year.

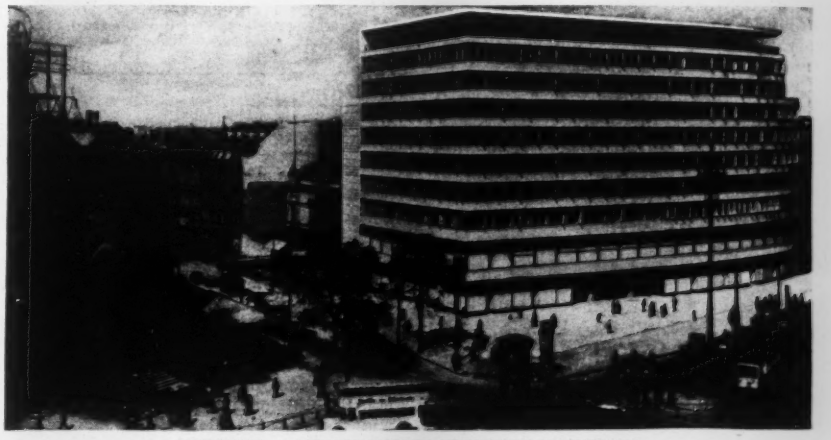
Illinois Society of Engineers Favors Engaging in Public Affairs

ENGINEERS' relations to public affairs and economic problems occupied one entire session of the annual meeting of the Illinois Society of Engineers, held at Chicago on Jan. 23 to 25. Since the engineer is largely responsible for the "machine age," said Paul Hansen (Chicago), he should assume economic leadership in order to show the world how it may enjoy engineering benefits without serious economic and social difficulties. It is in the public interest also that he should urge the value of public works and advocate their financing through loans and credit extension from the R.F.C. Robert I. Randolph was frankly pessimistic. He stated that though engineering societies have committees on public affairs and have offered services to local agencies, very little attention is paid to them.

A forceful exposition of the relation of public works and the engineering construction industry to present economic conditions and their relief, by W. T. Chevalier, publishing director, *Engineering News-Record*, was warmly received. He pointed out that public works benefit private investments, a fact not generally realized by those in control of private investments. The present situation is comparable to a manufacturing concern turning over its revenue to the stockholders, cutting running expenses and borrowing money to pay these expenses. One vital necessity is the reduction of fixed charges, such as interest on loans, rather than a reduction in effective operating expenses. That this burden of fixed charges due to continual borrowing, is a main reason why depressions exist, was pointed out also by H. J. Fixmer (Chicago). He suggested that the rate of interest should vary with some recognized index of market value, so that maturities falling due when the index is low would be deferred automatically until it again reaches normal.

Along the same line was a paper by M. L. Greeley (Chicago) pointing out that engineers benefit themselves and the public by taking part in public affairs, and that engineering societies should do the same.

Engineers are partly responsible for the decline of public and private improvement works by their habit of waiting for such



UNUSUAL 10-STORY OFFICE BUILDING IN BERLIN

The "Columbushaus" is the name of one of the newest and tallest office buildings in Berlin. Located at the Potsdamerplatz, it is a 10-story steel frame structure having a ground floor area of 18,300 sq.ft. The first floor with wide sliding windows is designed to house a cafe. The other floors are designed for division into office space with the exception of the top floor which with the ninth floor accommodates a large sheltered roof-garden and restaurant. Excavation work began in April, 1931. A total of 19,500 cu.yd. of dirt was removed to a depth of 27.9 ft. The structural steel frame was erected in 68 days. Elevators operate at a rate of about 300 ft. a minute. The basement houses all of the mechanical equipment, including central power station with a capacity of 280 hp., hot water supply system, water softening plant, a sewage lifting plant and a ventilating system. The interior temperature is maintained at 68 deg. F. during the winter and 77 deg. F. maximum during the summer with moisture held at 65 per cent regardless of atmospheric conditions.

construction works to give them employment, according to the report of the welfare committee, presented by G. W. Craig. This report recommended that county surveyors, now paid $6 per day when employed, should be on a salaried basis and their duties enlarged so as to cooperate with the county superintendents of highways. In a paper on the relations of state, county, township and city in Illinois, J. J. Kearney (city engineer, Berwyn, Ill.), considered the township much too small a government unit under modern conditions; much of its work and expenditure is wasted.

Engineer registration

As to the registration of engineers, H. E. Babbitt (University of Illinois) pointed out that in spite of opposition such registration exists in some form in 28 states. As Illinois is practically surrounded by states having such registration, the present question is not that of opposing or favoring the system, but rather what to do with it. Legal aspects of engineering problems were presented by D. H. Doane (St. Louis, Mo.) in regard to adjusting the payment of land drainage taxes to meet the present economic situation.

That the sewer rental system is not only advantageous in general but is of special advantage at the present time, since the work done under it is self-liquidating and therefore eligible for R.F.C. loans, was the argument of one of the most important technical papers. According to Ben H. Suhr (Chicago), 26 states and the District of Columbia have provision for fixing sewer rental rates, and such rates are actually charged in certain instances.

Storm-water standby basins, to store such waters when the stream into which they should discharge is at flood stage, were discussed by W. D. Hatfield, superintendent of the sanitary district of Decatur, Ill. Cities mentioned as having such provision for dealing with storm water included Columbus, Ohio, and Decatur, Ill. Trends in the design of tanks for separate sludge digestion, as reviewed by C. R. Velzy (Chicago), include shorter digestion periods, smaller tanks, better operation and control and better mechanical accessories. In a talk on the hazards from gas in sewers and sewage treatment works, Dr. R. R. Sayers, U. S. Public Health Service, indicated that it is a rare condition when the several elements are present in the proportions necessary to make the mixture inflammable and explosive.

Water supply problems

The problems of maintaining purity of the Chicago water supply from Lake Michigan were described in a paper by M. B. Reynolds, city engineer, and A. E. Gorman, engineer of water purification.

Ground-water supplies, used so extensively in Illinois, received a good share of attention. Subsurface reservoirs that occur in glacial deposits were discussed by M. M. Leighton, Illinois State Geological Survey, while A. M. Buswell, of the Illinois State Water Survey, reveiwed the mineral qualities of such waters and the methods of their purification. That treatment of ground waters for domestic purposes, especially softening and the removal of iron, will be an important feature in future waterworks activities was predicted by H. F. Ferguson, chief sanitary engineer of the Illinois State Department of Public Health. Household water-softening plants were referred to by E. E. R. Tratman, Wheaton, Ill. The treatment is necessarily of the rule-of-thumb order, more or less adequate amounts of chemical being dumped into the apparatus at uncertain intervals, but the results appear to be in general satisfactory.

Structural design of the Chicago World's Fair steel-frame buildings, described by B. M. Thorud (structural engineer of the World's Fair) includes a cable-suspended dome, three-hinged arches for an exhibition hall and 600-ft. steel towers. As salvage was an important factor in the design, bolted joints are used largely, but riveting and welding are also employed. A visit to the Fair site and buildings ended the convention.

A medal offered for the best paper of the 1932 meeting was presented to W. B. Walraven, Springfield, Ill., for his paper on "Development of Power from Sewage Sludge Gas." Officers for 1933 include: President, Morris L. Greeley, Chicago; vice-president, C. M. Slaymaker, East St. Louis, Ill.; secretary, H. E. Babbitt, Urbana, Ill. The 1934 meeting will be held at Springfield, Ill.

SOCIETY CALENDAR

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Feb. 21-24.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, annual meeting, Chicago, March 13-15.

ENGINEERING INSTITUTE OF CANADA, annual meeting, Ottawa Ont., Feb. 7-8.

AMERICAN CERAMIC SOCIETY, annual meeting, Pittsburgh, Pa., Feb. 12-17.

NATIONAL BRICK MANUFACTURERS RESEARCH FOUNDATION, annual meeting, Pittsburgh, Pa., Feb. 12-17.

SOUTHEASTERN SECTION, American Water Works Association, will hold its annual meeting at Albany, Ga., April 4-6.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS will hold its winter meeting at Albany, February 4.

INDIANA SECTION, American Water Works Association, will hold its annual meeting at Fort Wayne Ind., March 28-29.

MIDWEST ENGINEERING AND POWER EXPOSITION will be held at Chicago during the week of June 25, 1933. The date has been selected to allow engineers attending "Engineering Week" to visit the show.

COLORADO SOCIETY OF ENGINEERS held its fifth annual convention at Denver on Jan. 21. Governor Johnson spoke on the unemployment problem and the part that could be played by engineers. Others on the program included George W. Frasier, president of the Colorado State Teachers College, R. J. Tipton, T. S. Lovering, H. B. Barnes, H. L. Hartburg. C. A. Davis, city sanitary engineer, Denver, was elected president; Frank Prouty, Denver, vice-president; C. M. Lightburn, secretary-treasuer.

AMERICAN WOOD PRESERVERS ASSOCIATION held its 29th annual meeting January 24, 25 and 26 in Chicago. Calling the present a critical time for the wood industry, both architects and engineers stated that treated timber for buildings was not available, though builders would like to use it instead of one of the hundred substitutes. When treatment will prevent decay, be immune to termites and be non-combustible and the timber so treated can be had there will be plenty of it sold. Other papers included termite exposure tests, decay in building, combustion tests and fireproofing experiments, service records of ties, poles, marine piling and bridge timbers. Officers elected for the ensuing year are as follows: President, R. S. Beecher; vice-presidents, S. R. Church and F. D. Mattos; secretary, treasurer, Horace L. Dawson (reelected), Washington, D. C. The next meeting will be held in Houston, Tex.

Subway Contractor Wins Damages in 10-Year-Old Case

A verdict against the city of New York was returned on Jan. 26 in a ten-year-old damage suit growing out of alleged delays and changes in specifications on subway construction during the World War. The plaintiff was the Newman & Carey Co. who brought a suit against the city for $1,090,095 and against the Interborough Rapid Transit Co. for $4,340.

The construction company had a contract to build a section of the subway under Nostrand Ave., Brooklyn, work on which was begun in 1917 and completed in 1919. During the early part of the project the United States entered the war and the costs of materials rapidly increased. The company contended that the losses it suffered were occasioned by the city making changes in plans and specifications and otherwise delaying the work. The verdict included a judgment of $679,751 representing actual losses and $410,343 representing interest.

A tangle of legal technicalities had delayed settlement of the controversy for more than ten years.

Personal

P. J. REICH has been appointed assistant chief engineer of the American Bridge Co. with headquarters in Pittsburgh, Pa.

C. F. GOODRICH has been appointed assistant chief engineer of the American Bridge Co. with headquarters in New York, N. Y.

HUGH BARNHART was appointed director of the Indiana State Highway Commission Dec. 28. He is a newspaper publisher of Rochester, Ind.

GEORGE A. SOPER, consulting engineer, New York, has been made an honorary fellow of the Royal Sanitary Institute of Great Britain.

HARRY H. WELLS, chairman of the Florida State Highway Commission, tendered his resignation to the governor of the state on Jan. 5. In his letter of resignation, Chairman Wells said he was resigning at the request of the chief executive.

EMILE B. CAVALLO has been appointed to fill the newly created position of construction engineer for the Mississippi Highway Department, Tower Building, Jackson, Miss. The post was necessary under the $4,320,000 construction program now under way under the terms of the Federal aid act.

R. G. WAGGENER has withdrawn from the firm of Wood, Powell & Waggener, consulting engineers, Dallas, Tex., to engage in other business. E. A. Wood, W. J. Powell and W. L. Powell will continue their practice of engineering under the firm name of Wood, Powell & Powell.

J. D. Ross, superintendent of City Light Department of Seattle, Wash., has been reappointed for three-year term by Mayor John F. Dore. He has been head of City Light since 1911, serving under eleven mayors. M. O. SYLLIAASEN, city engineer has also been reappointed for a three-year term. He was appointed to this position last June, to complete the term of W. D. Barkhuff, killed in an automobile accident.

Obituary

JOHN G. MCFEE, railroad builder and general contractor, died at his home in Seattle, Wash., on Dec. 29, age 69 years.

JOHN G. PARKE, former engineer of the Pittsburgh Steel Co., and the engineer who fought vainly to save the dam which through its failure caused the Johnstown flood of 1889, died at Monessen, Pa., on Jan. 29, age 67 years.

HOLBROOK FITZ JOHN PORTER, secretary of the National Museum of Engineering Industry, died in New York on Jan. 25, age 74 years. Mr. Porter was one of the organizers of the American Museum of Engineering Industry and has served as its secretary since 1920.

CHARLES V. WESTON, consulting engineer for the Chicago Surface Lines and a director of Chicago Railways Company, died Jan. 27 at the age of 75. Born in Kalamazoo, Mich., he spent his early years on various railroads coming to Chicago in 1888. He was engaged on the construction of intake cribs and tunnels of the Chicago water works and in 1890 built the Van Buren St. street car tunnel. He became chief engineer for the elevated and at one time was president and general manager of the South Side Elevated Co., until the unification of the elevated lines in 1911.

DAVID P. GILMORE, head of the civil engineering department, University of Detroit, died suddenly of cerebral hemorrhage on Jan. 20. Professor Gilmore was 47 years old, a graduate of Pennsylvania State College in civil engineering in 1907. From 1907 to 1909 he was instructor in civil engineering at Pennsylvania State College and from 1909 to 1924 he was an instructor at the State University of Iowa in drawing and geometry, then assistant professor of mechanics and hydraulics and then associate professor of civil engineering. From September, 1924 to October, 1925 he was engineer of tests for the city of Detroit and in September, 1925 was made professor and head of the Department of Civil Engineering at the University of Detroit.

J. F. KABLE, engineer for the Pacific Iron Works in charge of the company's bridge operations, died at Portland, Ore., on Jan. 6. Mr. Kable was a civil engineering graduate of the University of Illinois and taught there and at the University of Wisconsin before becoming bridge engineer for the American Bridge Co. at Chicago. Mr. Kable went to Portland in 1906 where he practiced as a civil engineer for a time.

JANUARY CONSTRUCTION FIGURES TO APPEAR NEXT WEEK

The two pages of "Business Side of Construction," usually published in the first issue of the month, will be published for the month of January in next week's issue. The total of all engineering construction contracts reported for the month of January (four weeks) is $95,392,000. The *ENR* cost index for February is 159.30, and the volume index for January is 129.

Engineering Contracts and Capital

HEAVY ENGINEERING CONSTRUCTION contracts reported for the past week total $21,291,000, as compared with $17,517,000 reported the previous week. The average of contracts let the last four weeks is $19,656,000. The weekly average of contracts let in February of last year was $21,453,000. In cumulative contracts to date, this year is slightly ahead of 1932, with a total of $116,183,000, as compared with $115,034,000. Last week showed gains over the previous week in both private and public works classifications. Private contracts were $4,150,000, as compared with $3,644,000 the previous week. Public works awards gained from $13,873,000 to $17,141,000. Federal awards were little more than half the amount of the previous week, totaling $5,069,000. Highway lettings were unusually heavy for this time of year, amounting to $7,423,000. Large contracts reported during the week include highway awards in Illinois, $3,557,000; highways, New York, $1,186,000; oil pipe line, Kansas and Oklahoma, $1,000,000; a narcotic farm building, Lexington, Ky., $2,186,000; and a state hospital at Helmuth, N. Y., $2,515,000.

In the current list of proposed work is a hydro-electric development in Missouri, estimated at $15,000,000; widening of the Grand River, including new bridges, at Grand Rapids, Mich., $3,000,000; an intake tunnel for water supply, Cleveland, $2,000,000; a federal court house, Philadelphia, $2,900,000; and power transmission lines in Virginia, $1,000,000. Bids will be received soon for a brewery plant addition in Milwaukee, estimated at $1,500,000 and for the New York postoffice, $5,000,000.

Contracts and Capital

CONSTRUCTION

(Thousands of Dollars)

	Weekly Average Four Weeks Feb., 1932	Week Feb. 2, 1933
Federal government	$1,869	$5,069
State and municipal	9,721	12,072
Total public	$11,590	$17,141
Total private	9,863	4,150
Week's total	$21,453	$21,291
Cumulative to date:		
1932		$115,034
1933		116,683

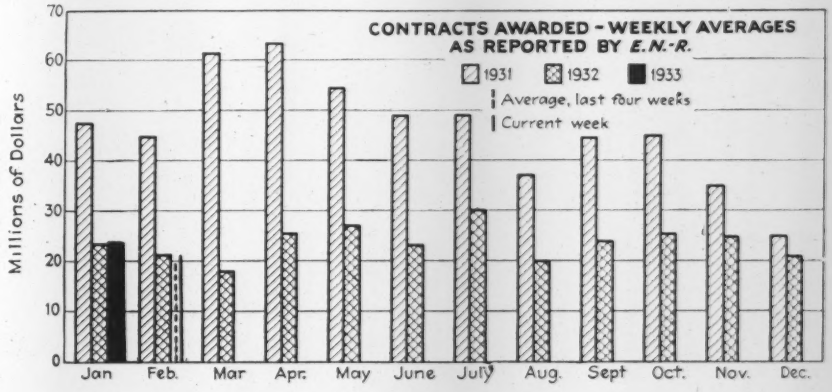
NEW PRODUCTIVE CAPITAL

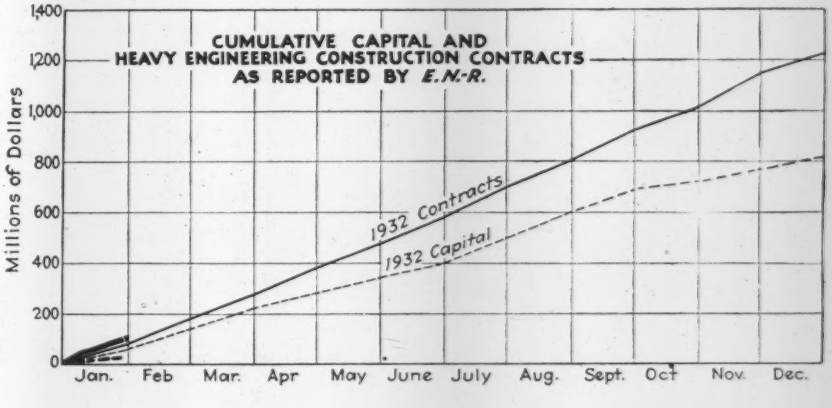
(Thousands of Dollars)

	Weekly Average Four Weeks Jan., 1932	Week Jan. 28, 1933
R.F.C. loans made		
New capital issues	$25,000	$6,300 $456
Total	$25,000	$6,300 $456
Cumulative to date:		
1932		$100,000
1933		25,200
R.F.C. self-liquidating loans:		
Approved current week		$1,598
Approved to date (including 1932)		149,249
Actual loans made (including 1932)		17,753

ENR Cost and Volume Index

E.N.-R. Cost		E.N.-R. Volume	
February, 1933	**159.30**	**January, 1933**	**129**
January, 1933	158.44	December, 1932	113
February, 1932	161.82	January, 1932	121
1932 (Average)	156.97	1932 (Average)	127
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.35	1930 (Average)	260
1913 Average	100		





Current Prices of Construction Materials

Building Materials

PORTLAND CEMENT — Prices are for carload lots. For cement in returnable cloth bags add 40c. per bbl.; in non-returnable paper bags add 15c. per bbl., to following net prices:

	F.o.b.	Delivered		F.o.b.	Delivered
Atlanta	$2.35	$2.85	Kansas City	$1.60	$1.70
Baltimore	....	2.03	Los Angeles	2.10	2.10
Birmingham	2.02	2.12	Minneapolis	2.10	2.25
Boston	1.92	2.12	Montreal	1.70	....
Chicago	1.60	1.95	New Orleans	1.90	2.20
Cincinnati	1.37	1.52	New York	1.59	2.20
Cleveland	1.77	2.00	Philadelphia	1.84	1.94
Dallas	2.80	3.00	Pittsburgh	1.87	1.97
Denver	....	2.40	St. Louis	1.74	2.15
Detroit	1.47	1.80	San Francisco	2.05	....
			Seattle	2.55	2.70

Current mill-prices per barrel to dealers, for carloads of 132 barrels or over, without including charge for four bags, f.o.b. Bag charges same as in preceding table:

Alpena, Mich	$1.20	Mason City, Ia	$1.35
Buffington, Ind	1.35	Norfolk, Va	1.61
Dallas, Tex. (Inc. 5c. tax)	1.80	Northampton, Pa	1.40
Hannibal, Mo	1.35	North Birmingham, Ala	1.60
Hudson, N. Y	1.50	Richard City, Tenn	1.70
Independence, Kan	1.35	Steelton, Minn	1.45
Ironton, Ohio	1.35	Universal, Pa	1.40
Iola, Kan	1.35	Waco, Tex	1.75
La Salle, Ill	1.35	Wyandotte, Mich	1.20
Limedale, Ind	1.35		

SAND AND GRAVEL — Per ton, carload lots, gravel, size ¼-in.:

	Gravel		Sand	
	F.o.b.	Delivered	F.o.b.	Delivered
Atlanta	$1.95	$2.75	$1.50	$2.50
Baltimore	....	2.55	....	2.08
Birmingham, per cu.yd	....	3.00	....	2.40
Boston	1.40	1.65	.90	1.15
Chicago, per cu.yd	....	2.25	....	2.25
Cincinnati	1.20	1.65	.95	1.40
Cleveland	....	2.00	1.40	2.00
Dallas, per cu.yd	1.40	2.40	1.65	2.40
Denver, per cu.yd	1.75	1.85	1.15	1.20
Detroit	.50	1.45	.72	1.50
Kansas City (at plant)	.75	....	.70	....
Los Angeles	1.35	1.45	.85	1.00
Minneapolis	....	1.60	....	.65
New Orleans	1.50	2.50*	1.20	2.00*
New York, per cu.yd	1.60	3.25	1.00	2.00
Philadelphia	....	1.66	....	1.38
Pittsburgh	....	1.20	....	1.40
St. Louis	1.15	1.40	1.00	1.25
San Francisco	1.65	....	1.65	....
Seattle, per cu.yd	1.75	....	1.75	....

*Cu.yd.

CRUSHED STONE — Per ton, size 1½-in., carload lots, limestone:

	F.o.b.	Delivered
Atlanta	$1.95	$2.75
Baltimore	....	2.60
Birmingham	.80	1.05
Boston	1.40	1.65
Chicago, per cu.yd, 2,500 lb	....	2.25
Cincinnati	1.65	1.85
Cleveland	....	2.00
Dallas, per cu.yd., 2,500 lb	1.65	3.00
Denver, granite, per cu.yd., 2,700 lb	....	2.50
Detroit	1.09	1.95
Kansas City	1.25	2.00
Los Angeles	1.35	1.45
Minneapolis	....	1.60
New York, per cu.yd., 2,800@3,000 lb	1.65	3.25
Philadelphia	....	2.00
Pittsburgh	....	2.25
St. Louis	1.35	1.65
San Francisco, trap rock	1.65	....
Seattle, per cu.yd., 3,000 lb	1.10	....

CRUSHED SLAG—Prices for carloads, per net ton, at plant:

	1½-In.	¾-In.	Roofing	Slag Sand
Birmingham	$0.90	$1.15	$2.05	$0.55
Buffalo	1.35	1.35	1.85	1.25
Cleveland	1.70	1.70	....	1.35
Toledo	1.20	1.20	1.20	1.10
Western Pennsylvania	1.25	1.25	2.00	1.25
Youngstown	1.10	1.20	2.00	.75

CONCRETE BLOCKS—Standard, 8x8x16-in., hollow, delivered to job, each:

Baltimore (8x12x12)	$0.20	Kansas City	$0.18
Birmingham (5x8x12)	.084	Los Angeles	.125
Boston	.14	Minneapolis	.085
Brooklyn and Queens	.12	Montreal	.14
Chicago	.175	New Orleans	.16
Cleveland	.165	Philadelphia	.15
Denver	.15	Pittsburgh	.18
Detroit	.09	St. Louis	.14

READY MIXED CONCRETE—Per cu.yd., 1:2:4, delivered 50 cu.yd. or more:

Atlanta	$7.75	Los Angeles	$5.40
Birmingham	4.90	Minneapolis	6.00
Boston	6.25	New Orleans	6.20
Cincinnati	6.10	New York (Manhattan)	8.50
Dallas	6.25	Philadelphia	5.98
Detroit 1:2½:5	4.75	Pittsburgh	6.05
Kansas City	7.50	St. Louis	6.80
		Seattle	5.35

HOLLOW TILE—Building tile per block, delivered to contractors in lots of 2,000 pieces or over:

	4x12x12	6x12x12	8x12x12	10x12x12	12x12x12
Atlanta	$0.09	$0.11	$0.13	$0.20	$0.25
Baltimore	.10	.14	.20	.22	.30
Birmingham	.089	.122	.167	.219	.25
Boston (at plant)	.075	.11	.14	.20	.30
Chicago	.0484	.063	.09	.1179	.15
Cincinnati	.06815	....	....	.165	....
Cleveland	.048	.066	.09	.117	.15
Dallas	.067	....	....	.173	....
Denver	.085	.135	.175	.19	.25
Detroit	.0505	.065	.0947	.1175	.1305
Kansas City	.0735	.092	.15	.1777	.20725
Los Angeles	.09425	.134	.188	.2325	.3115
Minneapolis	.0635	.09395	.1232	.13425	.2103
New Orleans	.085	.115	.16	.225	.255
New York	.075	.1164	.1455	....	....
Perth Amboy	....	....	....	.2388*	.2956*
Philadelphia	.065	.093	.14	.175	.195
Pittsburgh	.0435	.065	.088	.1165	.126
St. Louis	.06	.083	.112	.155	.195
San Francisco	.0765	.105	.1765	....	....
Seattle	.085	.115	.18	....	....

*At plant. (Load-bearing tile).

BRICK — Prices per thousand in carload lots, as follows:

	Common Backing		Paving
	F.o.b.	Delivered	F.o.b. 3x8½x4 in.
Atlanta	$8.50	$14.00	$32.00
Baltimore	....	11.50	43.00†
Birmingham	10.00	12.50	25.00
Boston	12.00	16.00	40.00
Chicago	....	9.00	32.00
Cincinnati	13.50	16.00	36.50
Cleveland	12.00	14.00	33.00
Dallas	11.00	12.50	25.00†
Denver	13.00	....	40.00
Detroit	11.50	12.50	25.00
Kansas City	12.00	13.00	35.00
Los Angeles	....	14.00	....
Minneapolis	....	7.50	....
Montreal	21.25	....	....
New Orleans	10.00	14.00	40.00
New York	9.50	12.50	45.00
Philadelphia	....	13.00	40.00
Pittsburgh	11.00	13.00	35.00
St. Louis	....	11.00	33.00†
San Francisco	....	14.00	45.00*
Seattle	12.00	14.00	....

*2½x8½x4 in. †3½x8½x4 in.

LIME — Prices of hydrated, per ton, in paper; lump, per 180-lb. bbl., net:

	Hydrated				Common Lump,
	Finishing		Common		
	F.o.b.	Delivered	F.o.b.	Delivered	F.o.b. Delivered
Atlanta	$13.50	$18.00	$11.50	$15.50	.... $2.50
Baltimore	....	20.00	....	13.00	....
Birmingham	21.00	....	12.00	....	$1.65 ....
Boston	13.50	16.00	11.75	14.00	2.30* 3.25*
Chicago	....	20.00	....	14.00	.... 2.75
Cincinnati	10.00	11.00	8.65	9.65	....
Cleveland	10.50	14.00	8.50	12.00	.... 2.50
Dallas	....	20.00	....	....	.... 2.50
Denver	....	30.00	....	22.00	.... 2.85*
Detroit	9.25	14.00	7.25	12.00	....
Kansas City	....	22.00	....	....	.... 2.75
Los Angeles	24.00	26.00	17.00	18.00	.... 2.00
Minneapolis	....	21.00	....	19.00	.... 1.70
Montreal	....	....	12.00	13.00	....
New Orleans	13.50	21.00	11.00	14.00	1.66 1.95
New York	10.70	14.50	8.60	12.50	2.25* 3.15*
Philadelphia	11.50	15.39	9.90	13.49	.... 1.18
Pittsburgh	10.70	12.20	9.95	11.45	1.85 2.35
St. Louis	....	.45‡	....	.40‡	.... 2.15
San Francisco	19.00	....	19.00	....	1.59 ....
Seattle	....	32.00	....	24.00	.... 2.80

*Per 280-lb. bbl. (net.) ‡Per sack.

LIMESTONE—Mill blocks, f.o.b. siding, per cu.ft.:
New York:* Rustic buff, $1.48; Standard gray, $1.48; Standard buff, $1.58; Selected gray, $1.58; Selected buff, $1.68; Variegated, $1.48.
Boston: Rustic buff, $1.47; Standard, $1.57; Selected buff, $1.67.
Pittsburgh: Rustic buff, $1.14; Standard, $1.24 at quarry; Selected buff, $1.34
Philadelphia: Sel. buff, $1.59; Sel. gray, $1.49; Standard, $1.49; Standard gray, $1.39; Rustic buff, $1.39.
Atlanta: Standard $1.26.
*F.o.b. Bedford, freight allowed to N. Y.

SLATE—Roofing, f.o.b. quarry, Bangor, Pa., net, per square;

No. 1 Clear	$8.25@$9.50
No. 1 Ribbon	6.75@ 7.50
Medium Clear	7.25@ 8.00

Road and Paving Materials

PAVING STONE — Granite, lots of 50,000 blocks, 4x8x4-in., dressed, f.o.b. city:

Atlanta	$3.00 per sq.yd.
Baltimore	43.00 per M.
Birmingham (3½x8½x4-in.)	76.25 per M.
Boston	80.00 per M.
Chicago, 5 in	3.80 per sq.yd.
Cincinnati	110.00 per M.
Cleveland	95.00 per M.
Dallas	25.00 per M.
Detroit, 5 in	2.80 per sq.yd.
Kansas City	2.75 per sq.yd
Minneapolis, 4½ in	2.80 per sq.yd
Montreal	104.75 per M.
New Orleans	2.80 per sq.yd.
New York, 5 in	135.00 per M.
Philadelphia, 4x10x5	115.00 per M.
Pittsburgh	115.00 per M.
St. Louis, 5 in	2.65 per sq.yd

Current Prices of Construction Materials

Road and Paving Materials—Continued

WOOD-BLOCK PAVING — Prices f.o.b., in carload lots:

	Size of Block	Treatment	Per Sq.Yd.
Atlanta	3½	16	$2.25
Boston	3½	16	2.00
Chicago	3½	12	1.90
Kansas City	3½	16	2.50
Minneapolis	3½	16	2.25
Montreal	3½	16	2.63
New York	3½	14	1.90
Philadelphia	3½	16	2.02
St. Louis	3½	16	2.00

CURBING—Per lin.ft., 5x16 in., straight, rough, f.o.b., in carload lots:

Atlanta	$0.41	Kansas City	$0.60
Birmingham	.50	New York	.62
Boston	.65	Philadelphia (6x20 dressed)	1.40
Dallas	.60	Pittsburgh	.80
Detroit	.45	St. Louis	.65

ASPHALT—Paving asphalt, f.o.b., per ton. Packages are 350-lb. bbl. or 425-lb. drums, in carload lots:

	Packages	Tank-car or -boat
Atlanta	$21.60	$17.40
Baltimore	19.00	15.00
Birmingham	.....	11.00
Boston	19.00	15.00
Chicago	22.50	15.50
Cincinnati (f.o.b. refinery)	.....	8.00
Cleveland	18.25	14.50
Dallas	.....	27.00
Denver	27.50	.....
Detroit	16.80	12.43
Kansas City (f.o.b. refinery)	18.00	12.00
Los Angeles (f.o.b. refinery)	18.00	12.00
Maurer, N. J. (Bermudez)	.....	26.00
Maurer, N. J. (Trinidad)	.....	22.00
Minneapolis (f.o.b. Twin Cities)	21.30	16.30
Montreal (f.o.b. factory)	17.00	13.00
New Orleans (f.o.b. refinery)	16.00	12.00
New York	19.00	15.00
Philadelphia	17.00	11.00
Pittsburgh	25.00	16.00
St. Louis	21.70	17.70
San Francisco (f.o.b. refinery)	16.00	10.00
Seattle	21.10	16.00

LIQUID ASPHALT — Residual, hot application, f.o.b., in tank cars, 8,000 gal. minimum, per gal.:

Atlanta	$0.0689
Baltimore	.06
Birmingham	.06
Boston	.055
Cincinnati	.075
Dallas	.05
Kansas City	.05
Los Angeles	.045
Montreal at (refinery)	.09
New York	.06
Philadelphia	.08
Pittsburgh	.05
St. Louis	.0778

EMULSIFIED ASPHALT — For penetration and surface treatment, per gal.:

Boston, applied	$0.11
Cincinnati, f.o.b. refinery	.06
Los Angeles, applied	.11
Des Moines, applied	.12
New York, applied	.15
Philadelphia, applied	.13
Pitt burgh f.o.b. refinery	.04@.06
St. Louis, applied	.125
Seattle, f.o.b. refinery	.055

Iron and Steel

	Pittsburgh	Chicago	Birmingham
STRUCTURAL SHAPES AND PLATES, per 100 lb., base, carload lots	$1.60	$1.70	$1.75
CONCRETE REINFORCING BARS, ½ in., billet, per 100 lb., carload lots	1.60	1.65	1.75
SHEETS, per 100 lb., carload lots:			
Hot-rolled No. 10	1.50	1.65	1.85
Hot-rolled annealed No. 24	2.10	2.30	2.35
Galvanized No. 24	2.55	2.95	3.00
TERNE PLATES, per package, I.C., 8-lb. coating, 20x28 in.	9.50	.....	.....
RIVETS per 100 lb., ½ in., structural, carload lots	2.25	2.35	2.70
SHEETPILING, per 100 lb., base, carload lots	1.90	2.05	.....
WIRE NAILS, per 100 lb., base, carload lots	1.80	2.00	2.40
HEAVY MELTING STEEL SCRAP, No. 1, per gross ton, at consuming point	8.25	6.75	7@7.50

TRIANGLE MESH—Plain, per 100 sq.ft., in carload lots:

Style Number	Size, In.	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill
032	4x4	22	$0.85	$0.86
049	4x4	28	1.07	1.10
068	4x4	35	1.30	1.34
093	4x4	45	1.68	1.72
126	4x4	57	2.08	2.13
153	4x4	68	2.47	2.54
180	4x4	78	2.84	2.92
245	4x4	103	3.75	3.84
287	4x4	119	4.34	4.35
336	4x4	138	5.03	5.16
395	4x4	160	5.83	5.98
036P	4x8	17	.64	.66
053P	4x8	24	.91	.93

TRIANGLE MESH—*Continued*

Style Number	Size, In.	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill
072P	4x8	31	1.14	1.17
097P	4x8	40	1.48	1.51
049R	4x8	24	.91	.93
067R	4x8	31	1.14	1.17
089R	4x8	40	1.48	1.51

WIRE ROPE—Discounts from manufacturers' list prices on regular grades of bright and galvanized, Eastern Territory, New York, and East of Missouri River:

	Base
Cast steel round strand rope	25 %
Galvanized iron rigging and guy rope (add to list)	7½%
Galvanized steel rigging and guy rope	12½%
Plow steel round strand rope	40 %
"Special Steel" and extra strong cast steel, round strand rope	32½%

Discount 5 points less than discount for Eastern territory: California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, Washington and Wyoming. Discount 10 points less than discount for Eastern territory: Arizona, Idaho, Montana and Utah.

EXPANDED METAL LATH—Per 100 sq.yd., painted, f.o.b., in carload lots 2.2 lb. per sq.yd., standard-mesh diamond lath:

Atlanta	$12.50	Los Angeles	$17.00
Birmingham	17.00	Montreal (2.5 lb.)	24.00
Boston	15.00	New Orleans	20.00
Chicago	10.60	New York	13.50
Cincinnati	11.00	Philadelphia	13.50
Dallas	18.00	Pittsburgh	13.50
Detroit	18.00*	St. Louis	15.50
Kansas City	17.00*	San Francisco	17.00*
*Delivered.		Seattle	17.00

STEEL FREIGHT RATES — Per 100 lb., effective Dec. 3, 1931, on finished steel products in the Pittsburgh District, including plates, structural shapes, merchant-steel bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc.; 40,000 lb. per car:

Atlanta, 36,000 lb	$0.60	Detroit	$0.285
Baltimore	.29	Kansas City	.59
Birmingham	.60	New Orleans, 36,000 lb.	.69
Boston	.42	New York, 40,000 lb.	.35
Buffalo	.255	Pacific Coast, 60,000 lb.	1.17*
Chicago	.36	Philadelphia	.31
Cincinnati	.285	St. Louis	.41
Cleveland	.205	St. Paul	.60
Denver	.92	* All rail.	

Railway Materials and Supplies

STEEL RAILS — Per gross for, f.o.b.

	Pittsburgh	Birmingham	Chicago
Standard rails	$40.00	$40.00	$40.00
Light rails	30.00	32.00	34.00
Re-rolled rails	26.00	.....	27.00

RAILWAY TIES — Prices f.o.b., per tie, for carload lots:

		6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Boston	Oak, untreated	$0.90	.....
	Pine, untreated	.85	.....
	Pine, creosoted	1.40	.....
New York	Long-leaf sap pine, untreated	.90	$1.10
	Dense yellow pine, untreated	.65	.85
Birmingham	White oak, untreated	.75	.95
	White oak, creosoted	1.35	1.45
	Southern pine, untreated	.35	.80
	Southern pine, creosoted	.95	1.35
Chicago	White oak, untreated	1.05	1.35
	Oak, empty cell, creosoted	1.40	1.80
	Oak, zinc treated	1.25	1.65
	Southern pine, creosoted	1.15	1.50
Los Angeles	Fir, untreated	.45	.....
	Fir, creosoted	1.15	.....
Philadelphia	Red oak, untreated	.95	1.15
	Red oak, creosoted	1.47	1.90
St. Louis	White oak, untreated	.80	1.25
	Red oak, untreated	.75	1.05
	Red oak, creosoted	1.08	1.65
	Sap pine or cypress, untreated	.65	1.00
San Francisco	Douglas fir, green, untreated	.45	.63
	Douglas fir, empty cell, creosoted	1.14	1.56
Montreal	Birch or maple, untreated	1.00	1.00
	Birch or maple, creosoted	1.25	1.55

TRACK SUPPLIES — Prices per 100 lb., f.o.b., for carload lots:

	Pittsburgh	Birmingham	Chicago
Angle bars	$2.55	$2.75	$2.75
Standard spikes	2.40	2.40	2.60
Tie plates	1.75	1.85	1.85
Track bolts	3.50	3.50	3.50

Pipe

WROUGHT STEEL PIPE — Discounts from standard list for delivery from warehouse, except at Pittsburgh, where prices are f.o.b. mill. List prices per ft. as follows: 1-in., 17c.; 3-in., 76½c.; 3½-in., 92c.; 6-in., $1.92.

	1 to 3-In. Butt Weld		2½ to 6-In. Lap Weld	
	Black	Galvanized	Black	Galvanized
Atlanta	44%	36.5%	42%	34%
Boston	55.5%	42.25%	51.35%	40.1%
Chicago	57.25%	44.71%	53.83%	41.29%
Cleveland	53.3%	42.3%	50.8%	37.8%
Denver	44.5%	32%	41%	28.5%
New York	56.14%	43.6%	52.72%	40.18%
Philadelphia	57.28%	46.68%	53.68%	41.80%
Pittsburgh	64%	52.5%	61%	49.5%
St. Louis	51%	38%	48%	35%

Current Prices of Construction Materials

Pipe—Continued

CAST-IRON PIPE — Prices per net ton, for bell and spigot pipe, Class B and heavier, f.o.b. in carload lots; gas pipe and Class A, $3.00 per ton extra:

	4-In.	6-In. and Over
Atlanta	$37.50	$34.50
Boston	41.00	38.00
Birmingham (Base)	33.00	30.00
Burlington (Base)	35.00	32.00
Chicago	41.50	38.50
Dallas	45.50	42.50
Los Angeles	41.50	38.50
New York	38.50	35.50
Philadelphia (rail delivery)	36.50	33.50
Pittsburgh	41.50	38.50
St. Louis	40.50	37.50
San Francisco	41.50	38.50

SEWER PIPE—Prices delivered, per foot, for standard pipe; 6, 8 and 12-in. are single strength and 18, 24, 30 and 36-in. are double strength:

	6-In.	8-In.	12-In.	18-In.	24-In.	30-In.	36-In.
Atlanta	$0.125	$0.21	$0.385	.....	$1.40	.....	.....
Baltimore	.10	.30	.58	.....	1.93	.....	$6.50
Birmingham	.18	.30	.54	$1.02	1.95	$3.50	5.00
Boston	.155	.24	.48	1.25	2.10	4.40	5.75
Chicago	.18	.28	.54	1.25	2.25	4.75	6.00
Cincinnati	.0945	.....	.2835	.....	1.125	2.448	.....
Cleveland	.135	.21	.405	1.125	2.025	4.824	7.38
Dallas	.236	.....	.7165	.....	2.70	.....	.....
Denver	.16	.23	.414	.816	1.44	.....	.....
Detroit	.0855	.....	.2625	.....	1.90	3.80	.....
Kansas City	.21	.335	.52	1.00	1.90	3.80	.....
Los Angeles(f.o.b.)	.2175	.2825	.5085	1.1865	2.034	3.69	.....
Minneapolis	.18	.23	.46	1.20	1.85	3.20	4.26
Montreal	.30	.45	.75	1.95	2.60	.....	7.20
New Orleans	.18	.30	.54	1.02	1.95	.....	.....
New York	.13	.21	.42	1.15	2.10	.....	.....
Philadelphia	.081	.126	.243	.65	1.17	2.376	4.615
Pittsburgh	.09	.18	.27	.62	1.22	2.45	3.68
St. Louis	.126	.180	.324	.840	1.44	2.75	3.50
San Francisco	.175	.25	.45	1.05	1.80	3.00	4.50
Seattle	.21	.30	.54	1.26	2.16	3.60	5.50

CLAY DRAIN TILE—Per 1,000 lin.ft., f.o.b., in carload lots, 4 in.:

Atlanta	$50.00	Los Angeles	$60.00
Birmingham	50.00	New Orleans	40.00
Boston	38.00	New York	35.00
Chicago	40.00	Philadelphia	36.00
Dallas	65.00	Pittsburgh	80.00
Denver	75.00	St. Louis	40.00
Detroit	40.00	San Francisco	67.50
Kansas City	65.00	Seattle	45.00

Miscellaneous

LINSEED OIL—Raw, in 5-bbl. lots, per lb., f.o.b.:

Atlanta	$0.65	Minneapolis	$0.08
Birmingham	.066	Montreal (per gal.)	.47
Boston (per gal. delivered)	.59	New York	.076
Dallas (per gal.)	.555	Philadelphia	.064
Denver (per gal.)	.77	Seattle (per gal.)	.69
Kansas City (per gal.)	.60	St Louis	.084
Los Angeles	.092	San Francisco (del)	.1125

WHITE LEAD—In oil, per 100 lb. keg., f.o.b.:

Atlanta	$12.50	Montreal	$ 8.20
Birmingham	12.50	New Orleans	11.00
Boston	11.00	New York	11.00
Dallas	14.00	Philadelphia	9.50
Kansas City	11.25	Seattle	11.50
Los Angeles	11.50	St. Louis	11.00

Note: Both white and red lead, dry, same prices as foregoing; red in oil, $1.50 higher.

CHEMICALS—Water, sewage treatment, road work, f.o.b., carlots, New York:

Bleaching powder, in drums, f.o.b. works, per 100 lb.	$1.75@2.00
Calcium chloride, 77-80%, flaked, in 400-lb. drums or 100-lb. moisture proof bags, f.o.b. works, freight equalized with points of competion, per ton	21.00
Chlorine, cylinders, per lb. delivered	.05½
Silicate of soda, in drums, f.o.b. works, per 100 lb.	1.35
Soda ash, 58%, in bags, per 100 lb.	1.22½
Sulphate of aluminum, in bags, per 100 lb.	1.25@1.40
Sulphate of copper, in bbl., per 100 lb.	3.00

MANILA ROPE—The number of feet per pound for the various sizes is as follows: ¼-in., 6-ft.; ½-in., 4-ft.; ¾-in., 3-ft.; 1-in., 2-ft.; 1¼-in., 1-ft., 8-in. Following prices are per lb. for ½-in. and larger, delivered in 1,200 ft. coils:

Atlanta	$0.16	Kansas City	$0.20
Baltimore	.225	Los Angeles	.1725
Birmingham	.20	Minneapolis	.175
Boston	.155	Montreal	.16
Chicago	.175	New Orleans	.175
Cincinnati (f.o.b.)	.21	New York	.16
Cleveland	.21	Philadelphia	.15
Dallas	.18	St. Louis	.145
Denver	.17	San Francisco	.155
Detroit	.18	Seattle	.155

BUILDING PAPER—Black, 50-lb. per roll of 500 sq.ft., in carloads, f.o.b., producing point $2.20

SLATERS FELT—In carloads, per roll, f.o.b., producing point $0.65

PREPARED ROOFING—Per square, f.o.b., in carload lots:

	Single Shingles*	Strip Shingles†	Rolls‡
Atlanta	$5.00	$5.75	$1.75
Boston	6.00	5.75	2.40
Dallas	4.50	3.60	1.90
Detroit	6.25	6.50	1.85
Montreal	6.40	6.20	2.68
New Orleans	5.60	5.50	2.0u
New York	6.50	6.25	2.50
Philadelphia	4.40	4.20	1.65
Seattle	8.75	5.50	2.25
St. Louis	7.30	6.35	1.89

*Slate finish, sufficient to cover 100 sq.ft. ‡Slate surfaced, in rolls weighing 85 to 90 lb. †4 in 1, hexagonal shape, with Underwriters' label.

ROOFING MATERIALS—In carload lots, f.o.b.:

	Asphalt Felt, per 100 Lb.	Tar Felt, per 100 Lb.	Asphalt Coating, per Gal.	Tar Pitch,* per Ton
Atlanta	$44.50†	$44.50†	$0.45	$44.50
Boston	2.40	2.40	0.33	27.00
Dallas	3.17	3.00	.75	38.00
Denver	2.00	2.00	.90	18.00
Montreal	2.62‡	2.02‡	1.40	1.63**
New Orleans	.....	2.50	.....	22.50
New York	2.40	2.40	.34½	28.00
Philadelphia	2.25	2.25	.33	20.00
Seattle	2.40	2.40	.55	27.90
St. Louis	2.51	....	.28	26.00

*In 350 lb. barrels. †Per ton. ‡Per roll. **Per English cwt.

WINDOW GLASS—Discounts from latest jobbers list, dated Sept. 15, 1928 for sizes above first three brackets:

	Single Thickness		Double Thickness	
	A Quality	B Quality	A Quality	B Quality
Atlanta	85%	85%	85%	85%
Birmingham	89%	91%	89%	91%
Boston	88%	90%	87%	89%
Dallas	85%	85%	85%	85%
Denver	84@5%	86@5%	84@5%	86@5%
Kansas City	85%	85%	85%	85%
New York	87%	89%	87%	89%
Philadelphia	88%	90%	88%	90%
Pittsburgh	90%	90%	90%	90%
Seattle	90@10%	90@20%	90@10%	90@20%

EXPLOSIVES—Price per pound for dynamite delivered:

	Gelatin 40%	Gelatin 60%		Gelatin 40%	Gelatin 60%
Atlanta	$0.215	$0.2375	Los Angeles†	$0.1725	$0.1925
Baltimore	.21	.255	Minneapolis	.18	.195
Birmingham	.13	.1525	Montreal	.1675	.1925
Boston	.215	.24	New Orleans	.19	.22
Chicago	.17	.195	New York	.245	.2675
Cincinnati (f.o.b.)	.22	.245	Philadelphia	.215	.24
Dallas	.22	.24	St. Louis	.145	.165
Denver	.19*	.21*	San Francisco	.1575	.1825
Kansas City, Mo.	.2025	.2225	Seattle	.1525	.175

*F.o.b Louviers. †F.o.b. arsenal.

Lumber

LUMBER—Per M. ft., b.m., No. 1, Common, rough, in carload lots:

SOUTHERN L. L. YELLOW PINE

	1 x 6 In.* F.o.b.	1 x 6 In.* Del.	1 x 8 In.* F.o.b.	1 x 8 In.* Del.	3 x 12 In.† F.o.b.	3 x 12 In.† Del.	12 x12 In.† F.o.b.
Atlanta	$14.00	.....	$15.00	.....	$35.00	.....	$45.00
Baltimore	.....	$40.00	.....	$43.00	.....	$42.00	35.00
Birmingham	.....	15.00	.....	15.00	.....	18.00	25.00
Boston	27.00	32.00	29.00	34.00	45.00	50.00	60.00
Chicago	.....	.....	.....	.....	.....	62.50	.....
Cincinnati	.....	28.00	.....	28.00	.....	35.00	35.00
Cleveland	30.00	38.00	32.00	40.00	46.00	54.00	.....
Dallas	.....	27.50	.....	27.50	.....	52.50	52.50
Denver	.....	31.00	.....	33.00	.....	45.00	.....
Detroit	30.00	32.00	30.00	32.00	32.00	32.00	45.00
Kansas City	26.00	.....	22.00	.....	44.00	.....	46.00
Minneapolis	.....	31.00	.....	31.00	.....	34.00	.....
Montreal	44.00	.....	45.00	.....	30.00	.....	.....
New Orleans	.....	18.00	.....	19.00	.....	50.00	.....
New York	22.00	24.00	23.00	25.00	50.00	52.50	50.00
Phil. No. 2(com.)	19.00	23.00	20.00	24.00	28.00	32.00	46.00
Pittsburgh	20.00	28.00	20.00	28.00	26.00	36.00	44.00
St. Louis	23.00	28.00	23.00	28.00	43.50	48.50	41.50

DOUGLAS FIR

	1 x 6 In.* F.o.b.	1 x 6 In.* Del.	1 x 8 In.* F.o.b.	1 x 8 In.* Del.	3 x 12 In.† F.o.b.	3 x 12 In.† Del.	12 x12 In.† F.o.b.
Baltimore	.....	$48.00	.....	$52.00	.....	$58.50	$70.00
Boston	$24.00	29.00	$26.00	31.00	$30.00	35.00	42.00
Chicago	.....	.....	.....	.....	.....	44.52	.....
Cincinnati	.....	.....	.....	.....	.....	42.50	42.50
Cleveland	30.00	38.00	32.00	40.00	40.00	54.00	.....
Denver	31.00	.....	33.00	.....	46.00	.....	50.00
Detroit	.....	.....	.....	.....	30.00	30.00	45.00
Kansas City	30.00	.....	32.00	.....	45.00	.....	48.00
Minneapolis	.....	31.00	.....	31.50	.....	36.00	.....
New Orleans	.....	21.00	.....	21.00	.....	42.50	.....
New York	19.00	21.00	20.00	22.00	22.50	24.50	24.00
Philadelphia	.....	.....	.....	.....	.....	28.00	30.00
Pittsburgh	.....	.....	.....	.....	30.00	44.00	30.00
St. Louis	28.50	33.50	28.50	33.50	31.00	36.00	31.00
San Francisco	.....	15.00	.....	16.00	.....	17.00	17.00
Seattle	10.00	11.00	12.00	13.00	12.00	13.00	12.00

*Form lumber, 16 ft. lengths. †Planks and timbers, 20 ft. lengths.

PILES—Prices of Nichols Bros., 90 West St., N.Y.C., per linear foot, pine, with bark on, f.o.b., New York; delivered from barge, 1¼ to 2c. per ft. additional:

Dimensions	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.09	$0.145
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.13	.195
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.15	.215
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.185	.225
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.2025	.225
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.265	.375
14 in.—2 ft. from butt	5 in.	85 to 89 ft	.305	442